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NEW YORK ZOOLOGICAL SOCIETY ANNUAL REPORT 1966

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NEW YORK ZOOLOGICAL SOCIETY

SEVENTY-FIRST ANNUAL REPORT

1966

THE SOCIETY'S OFFICES
630 FIFTH AVENUE, NEW YORK 10020

THE ZOOLOGICAL PARK
BRONX PARK, BRONX 10460

THE AQUARIUM
CONEY ISLAND, BROOKLYN 11224

THE ZOOLOGICAL SOCIETY IN 1966

FAIRFIELD OSBORN, *President*

IN ANCIENT CHINA there was a custom of identifying a year with some symbolic word. It is sometimes highly useful to adopt a custom from people of olden times, even those of thousands of years ago. There is good reason to do so in this case because the year 1966 cannot be more appropriately described than calling it *The Year of Scientific Accomplishment*. It is in this year, the seventy-first of our institution's existence, that two extremely notable advances in scientific work have been scored—one the establishment of the Laboratories of Marine Sciences; the other the initiation of the Institute for Research in Animal Behavior.

MARINE LABORATORIES

The former goal is the result of more than five decades of work in marine sciences that commenced at the old Aquarium at Battery Park. There a number of eminent scientists associated with our Society discovered through the study of marine organisms new principles that have been found to be keys to better understandings of organic life. In recent years such activities have become of ever greater importance and, thus, through the skill, efforts and perseverence of Dr. Ross Nigrelli and his numerous scientific associates, have culminated in justifying the construction of the Marine Laboratories adjacent to the present Aquarium. There is presently no other similar conjunction of research laboratories with an aquarium containing a large and diverse collection of marine life.

IRAB

The latter, namely, the Institute for Research in Animal Behavior, is a consequence of a decade or more of planning, resulting from aspirations that our institution should engage itself actively in advancing knowledge concerning one of the most important factors that so greatly influence the existence of all living organisms. Happily, in developing the plans for this Institute we found a keen, willing partner in Rockefeller University, whose President, Trustees and staff had for some time ardently wished to include within the scientific objectives of their university exploration into the origins and causes of behavior in animal life which in so many respects have a relationship, remote or intimate, to the actions and lives of human beings. It so happens that this partnership between a university such as Rockefeller and an institution such as our own represents in many respects the first cooperative effort of its kind where a wealth of scientific talent is merged with others experienced in the more intimate details of animal management and care and in whose custody there exists a wide range of animals, from large mammals to small invertebrates.

In bringing into existence these two new centers of still largely unexplored fields of science we are responding to one of the primary purposes for which the New York Zoological Society was created, namely, as expressed in our Charter, ". . . the promotion of zoology and kindred subjects . . . the expenditure of funds for zoological research and publication . . . the cooperation with other associations with similar purposes."

Zoo and Aquarium

It should not be thought that other highly-important developments have not occurred during the year. In no sense are they anticlimactic or secondary to the thrusting forward of our activities in the fields of science. Evidently, the constant development and improvement of the two public institutions under our administration—the Zoological Park and the Aquarium—are ever in the forefront of our interests and purposes. Time works its own changes and among these is the evolution of new concepts, as well as skills, not only as to what an institution such as a zoo and an aquarium should be but also how to apply new methods through which animal life may be more sensitively and imaginatively maintained in captivity. These new methods have another far-reaching effect in that they make an institution such as ours not only more desirable as recreational centers but far more meaningful as places where the public may gain an enrichment of ideas concerning animal life, its beauty and its meaning. In effect, many of the characteristics of the old-time zoo must be abandoned. No longer is it justifiable to maintain wild animals in conditions that are not as similar as possible to those in which they exist in nature. Many of the large zoos, both in our own country and abroad, have inherited from the past archaic buildings and facilities where animals have been confined in quarters no way suggestive of their environments in the wild.

The metamorphosis of a zoo such as ours is a long and costly effort, but we are well on the way towards this accomplishment as evidenced by the new Aquatic Birds House, Wolf Wood, the new bear exhibits that will shortly be under construction, and other similar installations. One new exhibit building is also nearing completion, namely, the World of Darkness that will harbor nocturnal species in environments that will provide for their contentment and welfare, and also, for the first time on such an extensive scale, reveal to the public many of the fascinating creatures whose lives are adjusted to existence beween dusk and dawn.

Another major project now well along in its planning stage is the creation of a great outdoor exhibit of outstanding species of African fauna—from elephants and giraffes to the lesser antelopes, as well as avian representatives. These will inhabit an extensive outdoor area of more than 21 acres, in the southeast portion of the Park, of free-ranging enclosures—no bars, no fences but the various animal groups separated by virtually invisible moats. Our aspiration is to create a highly dramatic display of African animals on a scale, and in an environment, not heretofore attempted.

In all these developments great credit must be expressed to General Director William Conway. He and his able staff are applying their skills, experience and imagination to transform our Zoo into an outstanding place where our animals may live under the best of conditions and where, as mentioned above, the public will be provided with rich experiences concerning the wonders of animal life.

The Aquarium is steadily growing as a public attraction. This year has been the most successful since its opening in 1957. Attendance has been larger than in any previous year, which was reflected by increased receipts from admission fees, as well as from parking and other facilities.

The purchase of the property west of the Aquarium, made possible by a gift from Trustee Laurance Rockefeller, is of great value in providing needed space for future development. This acquisition has made possible a successful negotiation with the City government whereby 8th Street, lying between the existing Aquarium land and the new property, will be closed and turned over to the Society's jurisdiction. This extensive new area will, among other values, provide urgently needed parking space for visitors.

The staff of the Aquarium, as well as that of the Zoological Park, is busily engaged in developing plans for major additions to existing exhibitions. The largest and most striking of these will be a new whale and dolphin stadium, which, we anticipate, will provide ancillary installations making possible research programs concerned with the study of these remarkable animals. Another new installation being planned is that of an exhibit of sharks and other large marine fishes.

GENERAL DEVELOPMENT FUND

The financing of the developments cited above calls for substantial capital investment. We initiated several years ago, as will be recalled, a fund campaign that, it is highly satisfactory to report, has met with considerable success. At the close of the present year $8,201,444, have been received and/or pledged for what we term our General Development Fund. Gifts, grants and legacies have come in from many different sources—from the members of our own Board of Trustees, from a large number of individuals, from several foundations, as well as from governmental agencies. We take this opportunity to express profound gratitude to all these sources of gifts because they will mean so much to our Society in trying to meet the opportunities that lie ahead.

It would be a dereliction to fail to state, however, that a steady buildup of our financial resources will be required in the future. In a period of expanding needs as well as ever-rising operating costs our Society will continue to require substantial additional funds if it is to realize its "destiny" as an outstanding public and scientific institution.

WILDLIFE PROTECTION

Years ago William Beebe, who so brilliantly served our institution for more than 50 years, wrote, ". . . when the last individual of a race of living things breathes no more, another heaven and another earth must pass before such a one can be again."

No statement could more fittingly epitomize the need for wildlife protection, an activity to which our Society is dedicated with all the means at its command. Fortunately, there is ever increasing consciousness of the critical threat to many forms of wildlife. Many people still tend to be over-pessimistic as to the future. While it is true that quite a few species of animals are near the borderline of extinction, much can be done to advance the cause of wildlife protection assuming that sustained and energetic efforts are employed.

In our own country, despite ever-growing urbanization and industrialization, much has already been accomplished to assure the long-term preservation of many animals that even a few decades ago were on the "critical list." The problem, however, continues to be complex in many parts of the world. In Africa, Asia and Latin America there continues to be, generally speaking, a lack of appreciation of the values of the heritage of animal life. But even in these continents there are tangible grounds for hope. The great richness of the fauna of Africa and parts of Asia is slowly becoming more widely recognized.

Our Zoological Society is concentrating much of its current effort in specific regions, such as East Africa, and as time runs on will hope to take advantage of similar opportunities elsewhere. The recognition by recently independent African governments, such as Kenya, Tanzania and Uganda, of wildlife values is distinctly encouraging and more than one might have expected even a few years ago. At the present time, consequently, a considerable portion of the funds we have available for this objective is being used in East Africa for *educational* purposes or, expressed more specifically, increasing public consciousness of the values of wildlife; for support given to National Parks and wildlife sanctuaries; and, finally, for field research which, in one way or another, contributes to knowledge concerning wildlife populations, migration patterns and other aspects of animal ecology.

However, the threat resulting from rapid and ever-expanding human population growth throughout the world is a cause of deep concern because of the steady infiltration of people into the natural sanctuaries that wildlife requires for continued existence.

MEMBERSHIP

It is highly satisfactory to note that the membership of the Society keeps increasing year by year and is now double what it was a decade ago. It is tempting to speculate why this is occurring in view of the fact that very limited funds are expended on membership promotion. Perhaps a major cause is that the impact of ever-increasing urbanization and industrialization of today highlights the fact that the Zoological Park and the Aquarium provide to people the wonders of nature as expressed in animal life—sources of inspiration and mental refreshment ever more difficult to experience elsewhere.

The number of dues-paying members at the year's end is 6,308. Membership dues aggregated $116,358 this year. The income derived, especially from Contributing and Supporting classes of membership, plays its part in assisting to meet the Society's current expenses.

TRUSTEES AND STAFF

It is a sadness to report the death of Trustee Richard C. Patterson, Jr., that occurred in October. Mr. Patterson served the Society with devotion for more than 11 years and contributed in a number of ways to its welfare.

A new trustee, Mr. Charles W. Nichols, Jr., was elected to membership on the Board of Trustees and is warmly welcomed to this association with the Society's work.

It is a pleasure to announce the election of Trustee Robert G. Goelet as a Vice President of the Society.

Early in the year Dr. Ross F. Nigrelli was appointed to the directorship of the Aquarium, succeeding Mr. Paul Montreuil, who returned to his native Canada to take charge of a new aquarium in Montreal. Mr. Robert Morris was appointed Associate Curator of the Aquarium succeeding Dr. Carleton Ray, who accepted a position with Johns Hopkins University.

The termination of 31 years of the highly capable and fruitful services of William Bridges as Editor and Curator of Publications occurred with his retirement in the early part of the year. Mr. Bridges is a man of unique personality and of many talents. His presence on our staff will be sorely missed.

* * *

As to the year ahead, it is quite possible that the adoption of that custom in ancient China of identifying it by some symbolic word may again be desirable. Our Society is on the *forward move*. It is a period of new ideas and developments. Perhaps one or more of these new developments will prove of special significance as has been the case in the current year. But whether this happens or not is immaterial. The main thing is that our institution is in what would be described in biological terms as a state of *creative evolution*.

THE ZOOLOGICAL PARK

GENERAL DIRECTOR'S REPORT & REPORT OF THE ZOOLOGICAL PARK

William G. Conway

Because zoos and aquariums are living institutions in a deeper sense than most of man's educational collections, it is hardly remarkable that they are entering a period of great change. The impact of man's technology upon all life today must annually surpass the effect of many previous centuries. And because live animal exhibits are representative of inhabitants of the globe's current habitats, rather than its past or possible future environments, it is not surprising that in this period of tremendous habitat destruction our zoo and aquarium find their efforts increasingly devoted to conservation.

Accelerated efforts to preserve vanishing species through captive propagation and public preoccupation with the fate of dying species such as the Whooping Crane and the California Condor are not individual concerns but the reflection of a deep-seated human uneasiness over the long-term future of all living things, including man, in an increasingly artificial environment.

The zoo and aquarium, as urban institutions, have the opportunity and responsibility to interject the lost elements of natural variety, natural beauty and natural history into a citified human environment increasingly more homogenous, more geometrically artificial and more rootless and to provide municipal man a better basis to form standards for a future in which his potentialities may be more fully realized. Zoo experiences tend to make us think in terms of a *desirable* future, not just of an inevitable increase in the tonnage of human biomass with consequent destruction of that natural interest and variety of space that has allowed man to evolve and which must be preserved if he is to remain human.

Zoos and aquariums have always served to bring wild creatures before that great majority of humans who would otherwise have no opportunity to see them, but recently this function has been curiously complicated. While urging those who can to seek animals in the wild and to visit national parks, we have now become aware that such visits in quantity will destroy the very habitats we most need to preserve. The fragility of certain animal and plant communities in the face of the sorts of human pressures applied to many of our National Parks has become all too evident. Zoos and aquariums must, in the long run, help present to urban man those segments of wild habitat which cannot withstand the well-meaning onslaught of large numbers of people. Access to National Parks will have to be restricted if their values are to be maintained, and we must speed up our modernization of zoos and aquariums to better present our animals as though they are in the wild.

Even the simplest presentation of *whole* animals has assumed new importance as man, more and more, devotes his formal attention to parts and tissues. During the 1964 London Symposium on "The Role of Zoos in Conservation," one scientist seriously questioned the importance of preserving present living species from the point of view that it might soon be within the grasp of geneticists to create new and more interesting ones. The implication that a totally man-made environment is an adequate, sufficiently stimulating, human habitat cannot help but frighten and discourage many conservationists. Such comments from the humanists' point of view are best characterized simply as short-sightedness. The importance of man's realization of his place within nature is the basic tenet of live animal exhibition in zoos and aquariums and today the improvement of these institutions is among the most deserving of the cultural and educational efforts of civilized man. No other voluntarily-attended institutions draw such overwhelmingly high public attendance. Where better can the plight of a vanishing animal arouse widespread human sentiment and public support than in educational, esthetically compelling presentations, combined with the creature itself and located in human population centers?

While these foregoing conceptual considerations are among those essential to the development of our institutions, the maintenance of our wild animal collections is essential to their realization; physically and morally our most pressing problem, yet the long-term propagation and maintenance of those wild animals which are unrelated to domestic forms, is practically prenatal as a science.

The application of knowledge, frequently detailed, of a species in the wild to the maintenance of that species in captivity has lagged. More remarkably, the difficulty of development of captive care systems for certain species well known in the wild often reveals surprising deficiencies in the depth of our supposed understanding. A broad scientific research program specifically oriented toward developing consistently successful methods of wild animal propagation and maintenance does not appear to exist anywhere in the world. In view of the shocking rate of destruction of natural environments and wildlife, the important drain on some species for research and for pets and the slaughter of wildlife for their by-products (not to mention the small but regular requirements of zoos and aquariums), it seems remarkable that general zoo and aquarium research on the maintenance of wild animals in captivity is not better supported and further advanced. The basics of the problem need scrutiny.

In the past most zoos imported far too few specimens of species they hoped to establish and the necessity for establishing long-term breeding groups was not forseen. Zoo facilities, not to mention aquariums, were not planned with propagation in mind and, today, facilities for this purpose are almost universally inadequate.

The attempt to maintain animals on a self-replacing basis with a single, small breeding nucleus in restricted facilities is usually doomed from the start. An accident can easily wipe out the group. The number of potential mates is reduced; thus inbreeding is speeded up and progress toward a less variable population is inevitable. Such populations may show reduced adaptability and, of course, various species show differential resistance and response to inbreeding. Perhaps in this way, zoos have lost, for example, Rheinardt's Argus, the Imperial Pheasant, Gayals and Addax. Some have now been replaced, others have not. Many herds in many zoos of each rare species is one solution.

The problems posed by restricted behavioral opportunities, by abnormal social situations and their effect on captive breeding require specially intense study. The importance of sociality, for example, has been demonstrated repeatedly. Its little understood effects include such widespread observations as that cows and chickens in groups eat more than they do as individuals; that tadpoles whose tails have been amputated regenerate them more rapidly when in a group; that animals reared together, even though they are not siblings, may be slow to breed. Most of us are already familiar with the dangers inherent in the complex social dynamics of group exhibits if misunderstood, of enclosing together species with innate patterns of dominance and aggression which are not recognized by exhibit mates. All too often we find species accustomed to living in troops, flocks and herds confined in pairs or trios in a zoo so that more room is available to show more species. We are convinced that zoos must show fewer species in larger groups in large replicas of their native habitats.

Animals dependent upon learning, in a major way, for the full realization of their behavioral repertoires may be specially prone to reproductive failure in a restrictive captive biome that offers little opportunity for experience and experiment. While animals such as the gorilla, the orang and the chimpanzee survive when taken as adaptive youngsters even though deprived of social stimulation and learning, the breeding records of these animals, whose sexual behavior is largely learned, is usually poor. Zoos are dealing with the problem of culturally-deprived primates, a result, in social species, of failing to provide the captive with opportunity for the optimum number of intra-species reciprocal reactions. This itself is a result of raising social animals by themselves or with but one or two other cage mates.

Two successful solutions to providing higher social species with opportunities to develop more normally in zoos are the maintenance of big groups and the provision for large, varied living space. Extensive herd paddocks and monkey islands are examples. Small or monotonous lavatory-type cages containing isolated pairs from social species must be among the most un-zoological of zoo displays.

To the extent that they are learned, traditional and home-range specific behavior patterns of wild populations are lost in captivity. Patterns of leadership and protection, such as those of cow elk and cow elephants, even of Musk-ox, could be lost in zoo populations unobserved. Thus it would be helpful if zoos developed actual tests to demonstrate their captive's behavioral complements in as full an amplitude as possible. The application of such tests to public exhibition is obvious. Future zoo exhibits may even attempt to provide substitutes for seasonal migration.

Species reproductively dependent upon innate and complex courtship programs cannot be expected to reproduce consistently in captive habitats which do not provide the special tools and environmental cues necesary for their breeding behavior. A bird that needs a vertical twig, an over-hanging bank for courtship and nesting; a mammal that needs a scent post, a burrow; a reptile that requires a cyclical temperature change, a sandy territory—each is more likely to reproduce when the proper ecological furniture is provided. And by catering to these needs, each animal's inevitable period of acclimatization to captivity may be shortened.

Limitation of territory combined with the captive animal's inability to escape aggression in a restricted cage space is a serious problem. While fighting has been so ritualized in many species that death or serious injury rarely results from intra-species conflicts in nature, zoos have found it difficult to create conditions which permit the maintenance of such behavioral conventions. In the zoo, fighting, inter- and intra-species, can be an important cause of mortality. Keeping too many species in too little space is the usual basis of the problem.

Responsive development of the captive ecology of zoo exhibits is a most deserving field. The effects of zoo climate, substrate, shelter, food and even visitors are just beginning to be defined. By maintaining adequate food supplies, we successfully winter certain tropical forms in the coldest of areas. The effect of changing day length, temperature and humidity must be individually assessed zoo by zoo and species by species. Why is it that Pronghorn Antelope are so often unsuccessful in Eastern zoos? Why is it that Polar Bears do relatively better but seldom breed in low latitude collections? Slender *Polyborus* caracaras will winter in Canada while their robust tropical cousin, the Harpy Eagle, can suffer frostbite even in Philadelphia's mild winters.

In recent years, zoos have made great strides in establishing their animal diets on a sounder nutritional basis by adopting farm feeding practices. Much of the credit for adapting generalized livestock nutritional advances to zoo use belongs to Dr. Herbert Ratcliffe of the Philadelphia Zoo. Now, however, further advances are necessary.

When dealing with relatively adaptable generalized species it makes sense to develop a few generalized rations to satisfy broad groups of animals' chemical needs on the basis of general nutrition. Every animal, we have reasoned in the past, needs protein, fat, carbohydrate, vitamins and minerals. A generalized ration providing amounts of these ingredients consistent with known requirements of related domestic forms will solve many of our problems. But specialized animals require specialized rations or rations specially presented, and this aspect of the zoo problem has not yet received sufficient study. We are a long way from developing adequate maintenance techniques for Cheetahs, Three-toed Sloths, Indris, Bushmasters, Swifts, Hoatzins, Jacamars, Marine Iguanas and Silky Anteaters.

Specialized animals must be met on their own terms. In some cases the importance of diet has been emphasized without collateral emphasis on the importance of the captive habitat. In the past the content of the ration has necessarily received much more attention than its form, its palatability or its manner of presentation.

Future efforts must adapt this knowledge to the animal and avoid stressing the captive to adapt him to unpalatable, improperly presented though chemically adequate foods. Creatures that eat at night should be fed at night. Animals that browse at bush height should be fed at browse height. The form and consistency of pelleted foods and special formulas must be modified in a species-specific way. And, for species which eat a little from time to time, we must provide a little from time to time. Zoos and aquariums must develop nutritionally sound rations that are also behaviorally sound.

It is already clear that developmental and behavioral problems are of prime importance in some zoo failures in consistent propagation of animals with specialized habits and diet, of certain social species and of higher forms. These problems greatly out-rank genetic difficulties in the establishment of rare species in captivity. It is not only necessary to develop morphological standards and stud book lineages for species we would propagate, it is also necessary to develop methods for recording and maintaining animal social and behavioral configurations.

In the final analysis, this means that more effort must be devoted to adapting captivity to each species, and that the long-term maintenance of typical wild animals in zoos will require at least as much zoological research as livestock husbandry. The development of a true science of animal care is clearly necessary to the fulfillment of the zoo's role in conservation.

NEW DEVELOPMENTS

The establishment of the new Osborn Laboratories of Marine Sciences and the Institute for Research in Animal Behavior were not only the most important developments of 1966 but among the most important in the Society's history. They are well chronicled in the President's report and in the reports of Drs. Nigrelli and Griffin.

The long-awaited "World of Darkness" has been delayed by a plumbers' strike and an opening before 1968 now seems unlikely. However, a new and promising plan for the "World of Birds" has been initiated and the new Alaskan and Polar Bear exhibit plans are now ready for construction, as are those for reconstruction of the Eagles and Vultures Aviary, the Kangaroo House and the Pheasant Aviary. Planning for the major outdoor zoogeographic exhibits "Africa" and "South America" has been delayed because of substantial increases in cost estimates. Most importantly, a new land-use plan for the Aquarium has now been developed.

Income from facilities was excellent during 1966 but the Society's request to the New York State Legislature for Charter revision to provide for a more realistic Zoo admission policy was ignored for the third year in succession.

With the retirement of Curator of Publications William Bridges, the Society lost a staff member whose exceptional contributions during the past 31 years have played a strong role in its activities and development. Mr. Joseph Davis, Curator of Mammals since 1958 and author of such innovations as the redlight exhibition of small mammals, resigned on December 31. Assistant Curator of Mammals Brad House has been appointed Chairman of the department.

During the Spring of 1966, Mr. Conway was appointed General Director of the Society. The Director's ancillary posts and activities during the year include election as President of the American Association of Zoological Parks and Aquariums and election as a Director of the National Audubon Society for a three year term. Mr. Conway continued to serve as a member of the Advisory Committee of the International Zoo Yearbook and as a member of the Survival Service Commission. He attended several national and international professional and conservation meetings and published several articles listed elsewhere. Two important papers were presented: "The Role of Captive Propagation in Wild Animal Conservation" and "The Problems in Propagating Wild Animals on a Long-term Basis."

Summary of Attendance

	1965	*1966*	*Average Attendance 10 Previous Years*
January	23,567	27,745	35,386
February	71,127	63,399	54,702
March	116,357	91,146	126,636
April	292,479	258,759	226,520
May	443,552	391,483	322,597
June	335,306	340,746	286,036
July	374,919	392,605	352,616
August	366,165	378,928	329,513
September	223,623	214,508	217,880
October	180,711	198,938	161,669
November	92,045	114,689	108,216
December	39,212	40,016	31,882
	2,559,063	2,512,962	2,253,653

The total number of visitors at the Zoological Park between its opening on November 9, 1899, and December 31, 1966, was 146,797,528.

Zoological Park Combined Census

December 31, 1966

	Species & Subspecies	*Specimens*
Mammals	197	739
Birds	560	1,805
Amphibians and Reptiles	248	619
Totals	1,005	3,163

DEPARTMENT OF MAMMALOGY

Joseph A. Davis, *Curator*
Hugh B. House, *Assistant Curator*
Grace Davall, *Assistant Curator*

Joseph Ruf, *Head Keeper*
Lee S. Crandall, *General Curator Emeritus*

The mammal department census of 739 specimens at the end of the year represented 197 species and subspecies, 52 families, and 14 orders. Representatives of two additional orders—Hyracoidea and Lagomorpha—were acquired during the year and there were small but gratifying increases in all other categories over the 1965 inventory.

The Collection

To further the possibility of breeding gorillas, a third pair was acquired to add to the already established group of four young Lowland Gorillas. The newcomers were approximately a year younger than the original foursome and the introduction was less than successful. The older males are roughnecks. They did not show direct aggression but maintained an intermittent campaign of idle harassment which, even though the older females showed some protectiveness, kept the youngsters off balance. As this began to reflect in their condition and demeanor, they were separated and will remain so until they become a match for their seniors in the rough and tumble gorilla world.

Toto, our young African Elephant, continued her schooling and, under the guidance of Keepers William Souhrada and Warren Lawston, appears to be a model pupil, responding well to control.

A highlight of the year was the acquisition of a young male Takin as a prospective mate for Gracie, who for years had the distinction of being the only Takin in the Western World. U. Mishmi, named for his homeland in the Mishmi Hills of Burma, has grown remarkably since his arrival on April 29. Though still smaller than Gracie, his horns are heavier and forming their first gnarl, portending his adult grandeur. Although an acknowledged adult, Gracie's own activities belie her age, and she takes in stride the fairly rough assaults of her playmate. While this unique species occurs only in remote mountainous areas, both of our Takins were taken when very young and hand-reared, which probably explains their quite placid adaptation to captivity. Optimism runs high that we may be successful in breeding the species.

The various species of Howler monkeys and the Proboscis Monkey prove to be difficult to maintain in zoological gardens, especially those in more northerly climates. We now have a pair of Red Howlers and a single Proboscis which appear to be established and doing nicely. Our degree of success with these animals over a period of time will indicate whether we will make further attempts to establish groups of each species.

FORMS NEW TO THE COLLECTION ACQUIRED IN 1966

Lump-nosed Bat—*Plecotus townsendii virginianus* Handley
White-faced Marmoset—*Callithrix geoffroyi* (Humboldt)
Proboscis Monkey—*Nasalis larvatus* (Wurmb)
Spiny Rat—*Proechimys* sp.
Pigmy Mouse—*Mus minutoides naevei* Thomas
Multimammate Rat—*Rattus natalensis* Smith
Fat Mouse—*Steatomys pratensis* Peters
Four-striped Grass Mouse—*Rhabdomys pumilio* (Sparrmann)
Hairy Tree Porcupine—*Coendou vestitus vestitus* Thomas
Sumatran Hairy-nosed Otter—*Lutra sumatrana* (Gray)
Jungle Cat—*Felis chaus* Gueldenstaedt

THE BREEDING PROGRAM

During the year the first births occurred in a collection of young big cats acquired over the past few years. Snow Leopards, Siberian Tigers, Spotted Leopards and Pumas gave birth and cubs of the first two species were successfully reared.

The Large Malayan Mouse Deer continue to propagate. From the original pair received in September of 1961, we now have 28 individuals, creating a housing problem that may be relieved by transfer of some surplus to other zoological parks.

The Mandrill family continued its growth, two births during the year bringing the group to a total of nine. Among other births in the Monkey House, perhaps the most notable was that of a Douroucouli, a species not often bred in captivity and our first on record.

A pair of White-handed Gibbons that have resided at the zoo for 24 years produced their 11th youngster, possibly a zoo record.

Our Gemsbok, Nyala, Blesbok, Jackson Hartebeest, White-tailed Gnu, Thomson Gazelle, Gray Duiker, Maxwell Duiker and Blackbuck herds all produced young through the year, creating space problems of real magnitude in many cases. Some surplus specimens went to the Henry Doorly Zoo in Omaha, Nebraska, and to the San Diego Zoological Garden.

Summarizing the above births, together with others not enumerated, it may be noted that 50 species produced a record 169 young during 1966.

PHYSICAL IMPROVEMENTS

"World of Darkness" construction continued through the year, although this was disappointingly delayed for six months by a Bronx plumbers' strike. "Wolf Wood" was completed and proved to be an exciting exhibit. Equally successful and popular, even though largely experimental, were two islands in Cope Lake for Siamangs and White-handed Gibbons.

Two pools for Pigmy Hippopotamuses were constructed in the Kangaroo House and the design proved to be practicable. More pools, based on the same design, will be added. Attractive and informative graphics were installed for the Wolf Wood, Père David Deer, Gibbon Islands, and Takin exhibits.

The Otter Moat received a much needed and effective face-lifting. Old and unsightly asphalt was removed, exposing natural rock, edged by gravelled areas. Hemlocks were planted and the pool was repainted. The active otter cubs continue to be a very popular exhibit.

The roof of the 60-year-old barn for Asiatic Deer was replaced, giving this venerable structure a new lease on life. The old Yak House was greatly improved with some added stalls, painting and a new roof.

Other improvements included winterizing certain outside dens and painting all interior cages at the Lion House. Cage renovation and decoration continued in the Small Mammal House and Monkey House.

RESEARCH

Once again two students joined the Department under the annual work-research program sponsored by the New York Zoological Society and Cornell University. Steven Singer worked with the great apes and Richard Kelleway made observations on the chevrotain group in the basement of the Monkey House. Cooperation was extended to various research institutions and individuals.

OTHER ACTIVITIES

Messrs. Davis and House attended the mid-winter and annual conferences of the American Association of Zoological Parks and Aquariums at San Diego and Washington and Miss Davall attended the Washington meeting.

PUBLICATIONS

MR. DAVIS

"Notes on 'M'Tundu'." *Animal Kingdom,* Vol. LXIX (2), 58-59.
"Maverick Opossums." *Animal Kingdom,* Vol. LXIX (4), 112-117.

MR. HOUSE & BOB MAHONEY

"Introducing 'Skip'." *Animal Kingdom,* Vol. LXIX (1), 2-7.

MR. CRANDALL

"A Zoo Man's Notebook." University of Chicago Press, 216 pp., illus.

SUMMARY

The collection has seen an increase in numbers of specimens, species, families and orders, also in the number of species breeding in the Zoological Park. Several important physical improvements were made and are underway, including new exhibits and much needed holding and reserve areas.

CENSUS OF MAMMALS
December 31, 1966

Orders		*Families*	*Species & Subspecies*	*Specimens*
MARSUPIALIA	Kangaroos, Phalangers, Opossums, etc.	3	11	21
INSECTIVORA	Moles, Shrews, Hedgehogs, etc.	3	4	13
CHIROPTERA	Bats	3	6	27
PRIMATES	Apes, Monkeys, Lemurs, Marmosets, etc.	7	38	109
EDENTATA	Armadillos, Sloths, Anteaters	3	5	8
LAGOMORPHA	Pikas, Rabbits, Hares	1	1	3
RODENTIA	Squirrels, Beavers, Mice, Porcupines, etc.	11	26	100
CARNIVORA	Bears, Raccoons, Cats, Dogs, Otters, etc.	7	48	120
PINNIPEDIA	Seals, Sea Lions, Walruses	2	4	4
TUBULIDENTATA	Aardvarks	1	1	1
PROBOSCIDEA	Elephants	1	3	4
HYRACOIDEA	Hyrax	1	1	1
PERISSODACTYLA	Horses, Tapirs, Rhinoceroses	2	5	9
ARTIODACTYLA	Cattle, Sheep, Antelopes, Camels, Giraffes, Deer, Swine, Hippopotamuses	7	43	319
	TOTALS:	52	197	739

Summary: Orders, 14; Families, 52; Species & Subspecies, 197; Specimens, 739.

DEPARTMENT OF ORNITHOLOGY

William G. Conway, *Curator*
Joseph Bell, *Assistant Curator*
Grace Davall, *Assistant Curator*
Andrew Winnegar, *Head Keeper*
Lee S. Crandall, *General Curator Emeritus*

The society's bird collection numbered 1,805 specimens of 560 species and subspecies at the end of 1966. There were 24 orders and 88 families represented, a gain over the 1965 count by the addition of two orders, 6 families, 15 forms and 240 specimens. A major portion of this increase was due to more than 100 specimens acquired and currently being used for studies by the Institute for Research in Animal Behavior. Waterfowl, however, still remain as the backbone of the collection with an all-time high count of 535 specimens of ducks, geese and swans.

The Collection

The decision, during 1966, to seek a new location for the proposed World of Birds exhibit, away from the traditional site of the Birdhouse on Baird Court was a fortunate development. With the old facility standing intact until the new one is ready, it will be possible to maintain and even increase our collection of small tropical species of birds in preparation for the future exhibit. Fifty-five specimens of five families were acquired during the latter part of the year as a part of this program.

Several of the acquisitions for the year are worthy of special mention. The addition of two species of rhea was of particular significance, for no representative of this interesting group has been exhibited here since 1962. Also, a group of Chilean Grebes purchased from a collector in South America represents our first serious effort to maintain the birds of this order (Podicipediformes) in the collection. Five North Pacific Murres and four Rhinoceros Auklets were new species added to our northern sea bird group in the Sea Cliffs exhibit at the Aquatic Birds Building. Also on the list of notable acquisitions were three Emperor Penguins, three Hooded Cranes and four Red-cheeked

Ibis. Five Horned Coots received in May are the first members of this high Andean form to be exhibited here. A Mossy-throated Bellbird, collected in Trinidad in 1959, was our most noteworthy loss for the year.

Forms New to the Collection Acquired in 1966

Chilean Grebe—*Podiceps rolland chilensis* Lesson
Puna Buff-naped Ibis—*Theristicus caudatus branickii* Berlepsch and Stolzmann
Puna Glossy Ibis—*Plegadis ridgwayi* (Allen)
New Zealand Shoveller—*Anas rhynchotis variegata* (Gould)
Burmese Red-thighed Falconet—*Microhierax caerulescens burmanicus* Swann
Brazilian Rail—*Laterallus melanophaius melanophaius* (Vieillot)
Yellow Rail—*Coturnicops noveboracensis noveboracensis* (Gmelin)
Horned Coot—*Fulica cornuta* Bonaparte
Black Oyster-catcher—*Haematopus bachmani* Audubon
Slender-billed Dotterel—*Oreopholus ruficollis* (Wagler)
Andean Lapwing—*Ptiloscelys resplendens* (Tschudi)
Puna Plover—*Charadrius alticola* (Berlepsch and Stolzmann)
Stilt Sandpiper—*Micropalama himantopus* (Bonaparte)
North Pacific Murre—*Uria aalge inornata* Salomonsen
Cassin's Auklet—*Ptychoramphus aleutica aleutica* (Pallas)
Rhinoceros Auklet—*Cerorhinca monocerata* (Pallas)
Black-throated Speckled Coly—*Colius striatus cinerascens* Neumann
Ringed Kingfisher—*Ceryle torquata torquata* (Linnaeus)
Sclater's Cotinga—*Pipreola sclateri* (Cornalia)
Many-colored Tyrant Flycatcher—*Tachuris rubrigastra libertatis* Hellmayr
White-tailed Nuthatch—*Sitta himalayensis himalayensis* Jardine and Selby
Chestnut-bellied Nuthatch—*Sitta castanea cinnamoventris* Blyth
David's Scimitar-babbler—*Pomatorhinus erythrogenys gravivox* David
Northern Pied Push-chat—*Saxicola caprata bicolor* Sykes
Sumatran Hill Myna—*Gracula religiosa robusta* Salvadori
Sudanese Crimson-faced Waxbill—*Pytilia melba soudanensis* (Sharpe)
Guadalupe Junco—*Junco insularis* Ridgway

The Breeding Program

The over-all success of the 1966 bird breeding season must really be measured by the results achieved with a few species that the Bird Department staff worked with on a long term basis. When a West Indian Flamingo hatched on the morning of June 28, 1966, it culminated years of plans and modifications to the flamingo flock and its proposed breeding area. The hatching and rearing of four Boat-billed Herons in the Treetops display at the Aquatic Bird House was another example in the same vein. Here too, the flock was carefully managed and nests were constructed and placed in suitable locations in the exhibit to encourage breeding. Both the flamingos and the boat-bills had not bred in the collection before. Inca Terns, Sunbitterns, Kittlitz's Sandplovers, African Spur-winged Plovers and

Black-necked Stilts all produced young again this year, but to this list we can now also add Chilean Lapwing, Black-winged Stilt, and White-faced Tree Duck. Snowy Owls nested for the first time this year but failed to rear the two chicks hatched. In all, 1,352 eggs from 84 species of birds were catalogued in the Department's "Egg Log" for the year and 143 birds of 43 species and subspecies were reared.

PHYSICAL IMPROVEMENTS

While there was no major renovation or construction in any of the bird areas during the year, many smaller improvements were effected by the Zoo's Construction and Maintenance Department. One of these items was the construction of a large, unheated shelter and feeding station for a group of ostriches wintering in the African Veldt exhibit. A special safety feature of this building was a series of trap doors that enable the keeper to feed these large and sometimes aggressive birds without entering their yard. Of similar note was a new system of feeding stations, that also serve as a permanent trap cages, constructed in a concealed spot under the Bird Walk in the Large Flight Cage. This new facility is of great help each fall in catching those species of birds which cannot withstand cold weather. An old bird shelter in the Phipps Cage was remodeled and equipped with electrical connections for heat lamps and food warmers, as an experiment in "wintering out" several birds of less hardy species.

New planting of larch, birch and holly were added to the European Waterbirds exhibit and the Marsh Gardens, and a new duck-breeding island planted with beach grass was added along the north shore of Heart Lake.

RESEARCH

Lack of staff limited research projects again this year to work on practical management problems and assisting in the investigations made by researchers from other institutions. One such project was conducted by Dr. John Teal, a scientist from the Woods Hole, Massachusetts, Research Station. Dr. Teal set up special equipment, including a portable wind tunnel, in one of our off-exhibit areas to measure the metabolism of various species of birds in flight. We supplied the birds and the "know-how" of handling. Our summer Student Research Program in conjunction with Cornell University was active again this season. The two students, working as part-time keepers, part-time researchers, were the same young men who worked here last year. They had requested permission to return and continue their studies of breeding behavior, incubation and chick development in aquatic species of birds. On the practical side, in a joint project with the

Mammal Department, five Cattle Egrets were introduced to a display featuring two Square-lipped Rhinoceroses in an effort to explore the possibilities of showing the symbiotic relationship between this species of heron with large grazing animals. This experiment was successful and opens the door to further experiments and displays of bird and mammal relationships. A new experimental program for propagating a reserve supply of water plants to stock the exhibits in the Aquatic Birds Building is working out well. A series of plastic pools set up in one of the Zoo's greenhouses, is being used for this purpose.

OTHER ACTIVITIES

Mr. Conway and Trustee Robert Goelet prepared script and aided the preparation of several thousand feet of film that they had taken in Argentina. The production, when finished, is to be titled "From the Pampas to Patagonia."

Mr. Bell gave a slide talk on the displays and breeding in the new Aquatic Birds Building at a regional conference of the zoos of northern New York State and Canada held in Buffalo in September. He also acted as a consultant on collection management for the Rhode Island Zoological Society.

PUBLICATIONS

MR. CONWAY:

"Sunday at the Zoo." A chapter for *Birds in Our Lives*, U. S. Department of the Interior, Bureau of Sports Fisheries and Wildlife, 190-198.

"Days in a Bird Blind on a Pampas Marsh." *Animal Kingdom*, Vol. LXIX (5), 148-153.

"Why Have a Zoo?" *Parks and Recreation*, Vol. 1, Number 6, 488-490.

MR. BELL:

"Nest Building for Zoo Birds." *Animal Kingdom*, Vol. LXIX (3), 76-78.

"Night Sounds in the Zoo." *Animal Kingdom*, Vol. LXIX (5), 140-142.

"Boat-bills in our Zoo's 'Treetops'." *Animal Kingdom*, Vol. LXIX, (6), 168-172.

"New York Zoological Park Avicultural News." *Avicultural Magazine*, Vol. 72, No. 6, 171.

SUMMARY

Waterfowl are still the mainstay of the collection but revised plans for the proposed World of Birds made it possible to increase our representation of smaller species. The breeding program resulted in the rearing of our first flamingo and several species that had not bred in our collection before. Research was limited but the Summer Student Research Program, sponsored by the Society and Cornell University, was resumed and two students continued projects begun in 1965.

CENSUS OF BIRDS

December 31, 1966

Orders		*Families*	*Species & Subspecies*	*Specimens*
SPHENISCIFORMES	Penguins	1	8	54
STRUTHIONIFORMES	Ostriches	1	1	5
RHEIFORMES	Rheas	1	2	7
CASUARIIFORMES	Cassowaries and Emus	2	2	3
TINAMIFORMES	Tinamous	1	2	11
PODICIPEDIFORMES	Grebes	1	1	6
PELECANIFORMES	Pelicans, Cormorants, etc.	3	8	21
CICONIIFORMES	Herons, Ibises, Storks, etc.	5	31	105
PHOENICOPTERIFORMES	Flamingos	1	6	56
ANSERIFORMES	Swans, Ducks, Geese and Screamers	2	105	535
FALCONIFORMES	Vultures, Hawks and Eagles	4	29	41
GALLIFORMES	Quail, Pheasants, etc.	4	27	78
GRUIFORMES	Hemipodes, Cranes Trumpeters, etc.	6	29	92
CHARADRIIFORMES	Plovers, Sandpipers, Gulls, etc.	10	52	239
COLUMBIFORMES	Pigeons, Doves and Sandgrouse	1	18	39
PSITTACIFORMES	Parrots, etc.	1	13	28
CUCULIFORMES	Touracos and Cuckoos	1	4	5
STRIGIFORMES	Owls	2	17	29
CAPRIMULGIFORMES	Frogmouths, Nighthawks, etc.	2	2	3
APODIFORMES	Hummingbirds	1	6	9
COLIFORMES	Colies	1	1	4
CORACIIFORMES	Kingfishers, Hornbills, etc.	4	14	26
PICIFORMES	Barbets, Toucans and Woodpeckers	3	13	24
PASSERIFORMES	Perching Birds	30	169	385
	TOTALS	88	560	1,805

Summary: Orders 24; Families, 88; Species & Subspecies, 560; Specimens, 1,805.

DEPARTMENT OF HERPETOLOGY

Herndon G. Dowling, *Curator*

Stephen Spencook, *Head Keeper*

The collection at year's end numbered 619 specimens of 248 species and subspecies of reptiles and amphibians. These figures are slightly under those for December 31, 1965, which were 639 specimens of 256 species and subspecies. The collection reached its high for the year on July 1 with 667 specimens of 274 species and subspecies.

Physical Improvements

The "center island" exhibits in the Reptile House underwent some renovation early in the year. The work—a joint effort with the Departments of Design and Construction—involved the resurfacing and painting of the open exhibits at either end of the "island," the west end for small crocodilians and the east end for turtles. There was also some redecorating of the interior python cages. One immediate result from the completed project was a greater viewability of the animals in their exhibits by the visiting public.

Late in the year, with the approach of winter, a new oil-burning furnace was installed in the Reptile Building, and it quickly did the job that was expected of it—providing a greater volume of heat at a more even flow.

The Collection

The most significant addition to the collection was a large Burmese Python *(Python molurus bivittatus)*, purchased from Mr. Wayne Farrell of Cranston, Rhode Island. The snake, born in captivity in 1951 and subsequently hand-reared, was reputed to be 17 feet in length and weigh 240 pounds. Our measurements, made on the day of its arrival, placed the snake's weight at 217 pounds and its length at 16 feet 4 inches. The difference might best be described as "normal snake shrinkage" from word-of-mouth estimate to the actual hard measuring. Even so, we still believe this specimen to be the largest snake of its kind in captivity.

Not long after we received the big snake the "tropical habitat" area at the east end of the Reptile House, used at the time for exhibiting large lizards and tortoises, was converted into an enclosure for large pythons. Five specimens, including the huge Burmese Python, were put into the enclosure, which is large enough to allow these animals to stretch out to their full lengths and presents a far better atmosphere for potential breeding than their former quarters.

Another important addition to the collection was a Gold's Tree Cobra from Africa, our first of this species and possibly the first at any American zoo.

There were a number of other significant additions during the 12-month period worth mentioning. In January, Visiting Research Fellow Allen Vinegar returned from a collecting vacation to Colombia with a small group of amphibians and reptiles, which he presented to the department. Included in the group were a caiman with good locality data and a Marine Toad of record proportions.

April brought us an unusual Boa Constrictor from Corn Island, a gift of Dr. Janis Roze. We say unusual because the specimen had remarkably large eyes for this species and possessed an aggressive temperament more typical of the arboreal boas. There were also donations of some large Vine Snakes *(Oxybelis)* from the American Museum of Natural History and an Anaconda from Research Associate Victor Hutchison.

In May, the department purchased a baby Morelet's Crocodile that had been collected in the Rio Hondo of British Honduras. This species has become quite rare and endangered due to the activities of hide-hunters. Later in the summer Mr. Alex Findlay of Weston, Ontario, sent us a group of 29 snakes, 14 turtles and 4 South American Iguanas, and Keeper Peter Brazaitis returned from North Carolina with two clutches of eggs, which eventually produced 6 baby Black Racers and 25 baby Eastern Hognose Snakes. Other births and hatchings during the year were Northern Copperhead, Boa Constrictor, Timber Rattlesnake and Dark Worm Snake.

The department sent two Asiatic Cobras to Tel-Aviv University, receiving in return two Palestine Vipers, a Horned Desert Viper, and a rare Desert Blacksnake *(Walterinnesia),* the latter a cobra relative.

In September, Keeper Joel Fischer returned from a trip to the desert of New Mexico with a group of lizards, and we purchased a female King Cobra as a possible mate to our older male. Unfortunately, the following month the male, which had been in the collection since 1953, succumbed apparently to old age.

RESEARCH AND OTHER ACTIVITIES

The Curator continued his work with the Navy on the manuscript for their manual "Poisonous Snakes of the World," and he continued his experiments with IBM and TERMATREX punch cards for possible use in the cataloguing of animals and information at the Zoo. Keeper Itzchak Gilboa prepared the index and a list of common names for the Navy manual, which is scheduled to be published in 1967.

Mr. Vinegar continued his work on the metabolism of pythons under Dr. Dowling's supervision, experimenting in the use of radiotelemetry to get internal temperatures of pythons without disturbing their normal day-to-day routine in captivity. He also collected data on the growth rates of snakes in relation to their food intake.

The Curator attended the following meetings:

First International Symposium on Animal Toxins, with Keeper Gilboa, in Atlantic City in April;

Annual meeting of the American Society of Ichthyologists and Herpetologists, with Messrs. Vinegar and Gilboa, in Miami in June. (Mr. Vinegar presented a paper on his python research);

Annual meeting of the American Institute of Biological Sciences, with Mr. Vinegar, at College Park, Maryland, in August;

Regional meeting of the American Association of Zoological Parks and Aquariums, in Buffalo, in September;

Centennial celebration of the Peabody Museum at Yale University, New Haven, with Mr. Vinegar, in October;

Conference on Mortality Statistics in Zoo Animals, in Oklahoma City in December.

(Mr. Vinegar also attended the special institute on bio-telemetry, in Washington, in August).

PUBLICATIONS

Hutchison, V. H., H. G. Dowling, and A. Vinegar: Thermoregulation in a Brooding Female Indian Python, *Python molurus bivittatus*. *Science,* 151 (3711): 694-696.

Hutchison, V. H., A. Vinegar, and R. J. Kosh: Critical Thermal Maxima in Turtles. *Herpetologica,* 22 (1): 32-41.

Whitford, W. G. and A. Vinegar: Homing, Survivorship and Overwintering of Larvae in Spotted Salamanders, *Ambystoma maculatum*. *Copeia,* 1966 (3): 515-519.

Brazaitis, P.: Snake Hunting in South Carolina. *Animal Kingdom,* 1966, LXIX (6): 175-179, 189.

Dowling, H. G.: Poisonous Snakes of Vietnam. *Animal Kingdom,* 1966, LXIX (2): 34-43.

Dowling, H. G. and P. Brazaitis: Size and Growth in Captive Crocodilians. *International Zoo Yearbook,* 1966 Vol. 6: 265-270.

CURRENT LONGEVITY RECORDS—1966

Species	*Arrived in Park*
Albermarle Giant Tortoise, *Geochelone e. elephantopus* (Harlan) (At Crandon Park, 1957-1962)	1928
Duncan Saddleback Tortoise, *Geochelone elephantopus ephippium* (Guenther)	1928
Indian Gavial, *Gavalis gangeticus* (Gmelin)	1946
American Alligator, *Alligator mississipiensis* (Daudin)	1950
American Alligator, *Alligator mississipiensis* (Daudin)	1951
Star Tortoise, *Geochelone elegans* (Schoepff)	1954
Burmese Python, *Python molurus bivittatus* Schlegel	1954
Giant Sideneck Turtle, *Podocnemis expansa* Schweigger	1955
Brown Sandboa, *Eryx johnii* (Russell)	1955
Flathead Sideneck, *Platemys platycephala* (Schneider)	1955
Hybrid Asiatic Cobra, *Naja naja kaouthia x N. n. naja*	1955
Dark Sidenecked Turtle, *Pelusios subniger* (Lacépéde)	1956
Black Sidenecked Turtle, *Pelusios Niger* (Duméril, Bibron)	1956
Mexican Beaded Lizard, *Heloderma horridum* (Wiegmann)	1956
Indian Gavial, *Gavialis gangeticus* (Gmelin)	1956
Chinese Alligator, *Alligator sinensis* (Fauvel)	1956

CENSUS OF AMPHIBIANS AND REPTILES

December 31, 1966

Orders	AMPHIBIA	*Species & Subspecies*	*Specimens*
CAUDATA	Salamanders	8	22
SALIENTIA	Frogs and Toads	12	34
TRACHYSTOMATA	Sirens	1	2
	REPTILIA		
TESTUDINES	Turtles	74	191
CROCODYLIA	Alligators and Crocodiles	17	55
SQUAMATA			
SAURIA	Lizards	35	91
SERPENTES	Snakes	101	225

Summary: Orders 6; Species, 248; Specimens, 619.

ANIMAL HOSPITAL

Charles P. Gandal, Veterinarian

As our overall zoo husbandry continues to improve, the importance of sound nutrition and early recognition of deficiency diseases assumes an increasingly important role. Many such problems are of an insidious nature and require extensive investigational work before an accurate diagnosis can be made. Such was the case with white muscle disease in our Nyala herd, which we continue to control with injections of selenium and vitamin E to all newborn. This past year we were surprised to find that on histopathological examination of numerous mammalian and avian tissues many sub-clinical cases of white muscle disease were evident. Dr. John Budinger has been instrumental in helping us to pinpoint this problem, and we are constantly aware of its dangerous potential and hopeful that the further use of specific blood chemistry tests may enhance our ability for early diagnosis. Some of our nutritional problems are much more clear cut. The calcium:phosphorus ratio in the meat diets fed our large felines has, in the past, created many problems in bone development of young animals. In spite of our best dietary manipulations the animals will frequently refuse supplements that are designed to balance the diet. We have now worked out a system whereby a straight calcium supplement is added to the meat diet on a "per pound of meat" basis, which simplifies matters for the keepers and helps them to understand exactly what we are trying to achieve, enhancing their cooperation and willingness to spend the extra time necessary to assure the intake of these supplements.

Investigational work published in 1966 revealed that New World primates cannot utilize vitamin D2 and, as with avian species, must be supplied with vitamin D3. This has been an extremely important piece of work insofar as zoos are concerned and explains many of the variables that heretofore have cropped up in caring for New World species.

Another extremely perplexing problem is the high incidence of fatty livers seen in our small mammals on autopsy. Much work remains to be done on the diets of these animals and on the importance of proteins and carbohydrates as well as vitamin and mineral balances.

The two Snow Leopards that were hand-raised in 1966 exhibited an interesting parallel to human nutritional problems. At approximately eight weeks of age they showed progressive signs of anemia with no apparent infectious or parasitic etiology. It was determined that the exclusive milk diet could well have induced an iron deficiency (this is well known in human nutrition), and iron injections, plus the addition of iron supplements and whole meat and liver to the diet, rapidly resulted in a reversal of the anemic trend.

For the first time in many years we have diagnosed thiamin defiency in our bird collection, most specifically in a group of Tufted Puffins. Though no changes in diet were made, the fish being fed had been frozen the previous year, and a full year's stay in the freezer might well have resulted in this deficiency. At any rate, the autopsy lesions on three birds were compatible with thiamin deficiency and supplementation of the diet resulted in an immediate reversal of the symptoms. It is interesting to note that we have also seen some calcium:phosphorus imbalances in hand-reared birds, and the problem of proper supplementation is not as great as is the problem of the bird picking certain ingredients out of the food and avoiding a balanced diet in favor of what to the individual may seem more palatable. Homogeneous mixtures are a necessity if no other means is available to insure adequate intake of a balanced ration.

Reptiles are by no means without their own particular nutritional problems and again this is a field that needs much intensive study. We have seen several cases of steatitis in our caiman collection and at present have a test group of animals on vitamin E supplementation, which we hope will correct the problem along with certain dietary changes. We also had gratifying results utilizing subcutaneous protein hydrolysate injections to maintain snakes that are not feeding on their own and are unsatisfactory specimens for force feeding.

PEDIATRICS

Throughout the year numerous interesting pediatric problems were presented, not the least of which were an infected errupting tusk, an ear infection and a chronic, low-grade foot infection on our new young African elephant "Toto." All of these responded quite well to appropriate therapy, and the ability of our keepers to handle this animal for treatment greatly expedited our care. The Snow Leopards and Siberian Tiger that were hand-reared in the Zoo presented numerous problems, not the least of which was a severe illness that affected "Natasha," the tiger. In one of our rare midnight emergencies she was given extensive medical treatment for an acute attack of pneumonitis.

Fortunately, she responded quite well. We are routinely using feline enteritis vaccine to protect our otters as they seem to be another animal that is susceptible to both canine and feline disease as are raccoons and mink. We continue to use mink enteritis vaccine along with the feline enteritis vaccine to achieve a higher degree of antigenicity in our vaccine program.

Other pediatric patients which bear mention are two young Lowland Gorillas, "Sukari" and "Chuma," that arrived on May 10 at 22 and 26 pounds, respectively. The two went through the acclimatization at the Hospital, giving us the normal amount of worrisome days, but responding well to whatever medication seemed indicated for their particular problems.

Tuberculin Testing

Our second round of tuberculin testing produced no positive tests among our monkeys. The five animals that had been on INH therapy, following suspicious original tests, all reverted to negative tuberculin status.

We have also initiated a program for tuberculin testing our deer herds and are hoping to develop a satisfactory ophthalmic test which will enable us to read the tuberculin test without the necessity of catching the animals a second time, as is presently done in our primate testing program.

Diagnosis of Tetanus

Among our clinical cases was the diagnosis of tetanus in a Himalayan Tahr and a female Grevy Zebra. The tahr, in an advanced stage of the disease when initially treated, soon succumbed. However, the results of our intensive treatment of the zebra, utilizing massive daily doses of antitoxin, promazine hydrochloride (a tranquilizer) and antibiotics, were most successful and along with good nursing care effected a complete recovery.

Obstetrics

Several obstetrical cases are worthy of note, since there is very little cause for obstetrical assistance in most zoo births. A Red Deer required anesthesia and instrumentation to remove a malpresented fetus which was successfully done in the relatively short span of 35 minutes, and we were called upon to assist in the delivery of stillborn leopard cubs. The injection gun was utilized to facilitate these procedures and many others, including treatment of a postpartum infection in a female Buffalo, a severe foot infection in one of our Polar Bears, and a swollen knee in our Riding Track camel.

Bobcat Case

Another interesting case was one in which Dr. Paul Skok, a neurosurgeon, performed a dorsal laminectomy, or removal of the top portion of the vertebrae, from our Bailey's Bobcat which had suffered a deformity of the spine subsequent to a calcium deficiency. When she was brought to the Hospital and given proper supplements her spine calcified in such a manner that there was pressure on the spinal cord which caused a walking defect. Unfortunately, the disease process was too far advanced and though the operation did temporarily alleviate the condition it recurred in a matter of months.

Avian Surgery

Methoxyflurane anesthesia, either alone or in combination with our standard avian anesthetic, Equithesin, was used routinely during the year in avian surgery. In addition, we initiated trials of an avian hypnotic, Methoxymol, which seemed to have some indications for use within our collection, especially as an orally administered agent to large birds that could not be readily apprehended, such as ostrich, emus, cranes, etc. Two deaths, an Eider Duck and a Common Murre, were recorded from blastomycosis, the first such within the memory of the veterinarian.

Reptile Work

The reptile collection continues to be a challenge to our veterinary services and several investigations are under way which should help us in our clinical work. A project was started late in the year to determine blood levels of a broad-spectrum antibiotic, oxytetracycline, to give us an indication of the frequency that snakes must be treated to achieve satisfactory antibiotic blood levels.

Further anesthetic trials with Methoxyflurane have proved its value as a reptilian anesthetic and we are hopeful of adapting our gas anesthesia machine to use on reptiles and are studying the effects of other anesthetic and narcotic agents for practical use in handling of specimens.

It is interesting to note that our treatment of the common "mouth rot" has indicated the value of keeping the affected areas clean and free of necrotic tissue . . . this in itself often bringing about a satisfactory cure, although we now tend to use tetracycline topical powder as we feel that following debridement this product stays in apposition to the infected tissues much better than liquid and ointment type materials formerly utilized.

The python that we operated on for a massive fibrosarcoma of the jaw in 1965 showed a gradual recurrence over the winter and in April it was decided to remove the remaining neoplastic tissue. Again, Methoxyflurane anesthesia was used quite successfully, and this time an oral approach was utilized rather than invading the skin of the lower jaw. We were able to completely visualize the tumor mass and do a more extensive and complete dissection than had been possible previously, resulting in what we feel is an excellent chance for the future of this animal.

Anesthesia Machine

We are pleased to report that our newly acquired anesthesia machine, specifically made for Methoxyflurane anesthesia, has been an invaluable aid to our surgical procedures. As we gain further facility with it and acquire supplementary equipment so that it can be utilized on a wide variety of animals it will be of even greater value, since it is extremely safe and relatively simple to use.

Dr. John Budinger

Mention must be made of the fine relations we have continued to have with Dr. John Budinger, who has supplied us with much invaluable pathology service, is conversant with our problems, and has stimulated our desire to conduct further research on a broad-based zoo level. Throughout the year, Dr. Budinger examined 427 individual specimens, all of which have been fully recorded. In addition, he has catalogued and filed our complete autopsy records including tissue sections, which now number well over 20,000.

Animal Commissary

In November Walter Cavanagh, who had ably operated our Animal Food Commissary, resigned to take another position in upstate New York and was replaced by George Fielding of the Mammal Department.

Miscellaneous

The veterinarian received an appointment as Assistant Professor of Clinical Pathology at New York University Medical Center and was reappointed as Research Collaborator at the Brookhaven National Laboratory. The veterinarian was named to the National Veterinary TV Advisory Board of the American Veterinary Medical Association as senior member of the exotic and zoo animal section, and a member of the Satellite Regional Primate Colony Planning Committee.

A total of 455 specimens were dispatched to 16 investigators, including such widely diversified material as avian muscle and liver tissue to Dr. Allan Wilson, Department of Biochemistry, University of California, for lactic dehydrogenase determination; a mouse deer cadaver to Dr. Robert Habel, head of the Anatomy Department at the Cornell Veterinary College, and reptilian parasites to Dr. Horace W. Stunkard, Research Associate at the American Museum of Natural History.

PAPERS AND PUBLICATIONS

Papers presented were:

"Care and Handling of Exotic Pets," First Annual Exotic Animal Symposium, New York City Veterinary Medical Association.

"Pet Primates: Their Care and Handling," American Animal Hospital Association, Region 1, Annual Meeting.

"Working With Your Veterinarian," Mid-winter AAZPA Meeting, San Diego, California.

"Exotic Pets: Their Care and Treatment," Baltimore Veterinary Medical Association Meeting.

"Potentials for Zoo Research," Oklahoma City Conference on Zoo Record Keeping.

"The Zoo Veterinarian and Conservation," National Parks and Recreation Association, Annual Meeting, Washington, D. C.

"Veterinary Seminar Panel," National Parks and Recreation Association, Annual Meeting, Washington, D. C.

Publications were:

Tuberculin Testing Monkeys, Gandal, Charles P., Current Veterinary Therapy, 1966, page 562.

Neoplasia in Parakeets, Gandal, Charles P., Current Veterinary Therapy, 1966, pp. 528-530.

A Digenetic Trematode, *Parahaplometroides basiliscae* Thatcher, 1963, from the Mouth of the Crested Lizard, *Basiliscus basiliscus,* Stunkard, Horace W., and Charles P. Gandal, Zoologica, Vol. 51, Issue 3.

White Muscle Disease in a Breeding Herd of Nyala, Gandal, Charles P., International Zoo Yearbook, Vol. 6, pp. 277-278.

Snakes Get Sick Too, Gandal, Charles P., Animal Kingdom, Vol. LXIX, No. 4, Aug. 1966.

The veterinarian attended the following meetings:

Cornell Annual Veterinary Conference and Cornell Public Health Conference, Ithaca, N. Y.

First Annual Exotic Animal Symposium, New York City Veterinary Medical Association.

Anesthesia Seminar, New York City Veterinary Medical Association.

Mid-winter AAZPA Meeting, San Diego, California.

Dermatology Seminar, New York City Veterinary Medical Association.

Purina Feed Seminar, New Jersey.

Oklahoma City Conference on Zoo Mortality Statistics. National Parks and Recreation Association, Annual Meeting, Washington, D. C.

FIRST AID AND LABORATORY STATISTICS

Vencenza Martine, R.N., our regular nurse, and Peggy Cahn, R.N. our weekend nurse, treated 1,284 first aid cases, of which 550 involved our own employees. Seven members of the blood bank donated blood and five pints were given to three recipients.

The Hospital Laboratory recorded 641 specimens, including routine bacterial cultures, sensitivity tests, blood, urine tests and stool examinations. Of these 418 involved mammals, 112 birds, and 111 reptiles.

* * *

In the Mortality Tables which follow, "Total in Collection" is arrived at by adding to the census at the beginning of the year all animals acquired by purchase, exchange, gift, or born alive. Animals disposed of alive by sale or exchange during the year are not deducted. No acclimatization period following birth or arrival is allowed.

MORTALITY TABLE

MAMMALS

Year	*Total in Collection Throughout the Year*	*Died*	*Mortality Percentage*
1966	970	159	16.21
1965	974	156	16.01
1964	857	134	15.63
1963	839	136	16.20
1962	808	202	25.00

Average Mortality for Past 5 Years....................17.69

Average Mortality for Past 20 Years..................17.57

BIRDS

Year	*Total in Collection Throughout the Year*	*Died*	*Mortality Percentage*
1966	1996	239	11.97
1965	1991	270	13.56
1964	1866	331	17.59
1963	2012	334	16.60
1962	1890	385	20.36

Average Mortality for Past 5 Years....................15.98

Average Mortality for Past 20 Years..................16.50

DEPARTMENT OF EDUCATION

HERBERT J. KNOBLOCH, *Curator*

INGER B. BRADBURY, *Zoology Instructor*

BONNIE D. GREEN, *Zoology Instructor*

CONTINUING THE PATTERN SET some years ago, 1966 was another record year for school classes and other organized groups visiting the Zoological Park. All of the figures quoted below are new records. The totals for the year, compared with 1965, are:

	1965	*1966*
Schools, Organizations and Institutions	5,273	5,996
Classes and Organized Groups	8,429	12,072
Total Class/Group Attendance	274,941	330,783

Attendance by groups during the summer months was again excellent.

	July	*August*
Schools, Organizations and Institutions	917	703
Classes and Organized Groups	1,696	1,283
Total Class/Group Attendance	51,806	41,361

VISUAL AIDS

The department helped in the production of two motion pictures, "Zoo 66" and "Highlights and Happenings at the Aquarium," for showing at the Annual Meeting.

There were 106 rental orders for Society films, which were viewed by 12,378 persons. Staff officers showed 78 films on 44 occasions to audiences totaling 7,495. During the 50 special programs of our films outside the park, 77 films were seen by 7,466 people.

GUIDED TOURS

There were 81 guided tours of the park conducted for 2,928 students.

SCHOOL LECTURE SERVICE

Michele Perrault, Inger Bradbury and Bonnie Green paid visits to 157 schools, giving 349 talks illustrated with animals to 61,296 students.

ANIMAL NURSERY

The Animal Nursery opened for the season on Saturday, April 9, and closed on Sunday, October 30. It was staffed by Miss Hanna Hinsch and Miss Patricia Duggan.

PERSONNEL

Miss Perrault terminated her employment with the Society on August 12. She resigned to accept a teaching position. Miss Green joined the department as Zoology Instructor on August 15, replacing Miss Perrault. Miss Green is a graduate of the University of Connecticut.

Miss Geraldine Cunningham came to us from Fordham University as part of the Urban Corps—Summer Internship Program sponsored by the Department of Personnel. She assisted the department in many capacities from June 17 until September 2 when the program ended. She rejoined us in mid-September to help with the film library, working until the end of the year.

Miss Aida Segarra, a commercial high school student, joined the department temporarily on July 5, as part of the Board of Education Vocational Work-Study Program. She assisted with clerical work until August 31, when the program ended.

LECTURES

Twenty-nine lectures were given during the year to audiences totaling 1,357 persons. Members of the department appeared on six television programs.

AUDITORIUM

The completion of the auditorium at the end of March was followed by the start of the At-Zoo Natural History Programs in that facility on April 4. Throughout the remainer of the spring and fall terms, 78 programs were presented for 221 classes totaling 6,245 students for grades 2 through 6.

MISCELLANEOUS

Our 33rd and 34th In-Service courses for elementary, junior and senior high school teachers, entitled "Utilization of the New York Zoological Park in the Science Program for Elementary and Secondary Schools," were given during the spring and fall terms. More than 80 teachers participated.

Mr. Knobloch assisted with the planning and installation of the sound system in the auditorium. A large portable sound-proof projection booth was designed and installed. The Curator also took part in the planning and installation of a new public address system in the Zoo.

Three special New Haven Railroad "Zoo Trains" brought 2,968 visitors to the Park from New England states.

As a community endeavor, the Society was invited to join the 52nd Police Precinct Community Council and participate in its activities. Mr. Knobloch was asked to represent the Society and chair the Council's Parks and Recreation Committee.

Two more eight-week Saturday morning Natural History Workshop courses were given for junior high school students during the spring and fall school terms, and a summer program of workshop courses was conducted for 229 children from the 3rd through 9th grades.

In August, as an experiment, natural history programs in the auditorium were offered to the general public. They were advertised by a sign on display at the entrance of the Heads & Horns Museum, announcements on the Tiger Trains and by personal invitation. The 45-minute programs consisted of a lecture with animals and a movie. They were well attended and quite successful.

TELEVISION SHOW

In late August, with the signing of a contract for a pilot film, the Society embarked on a television series with WABC-TV in New York. The shows were written, directed and produced by Frank Buxton and hosted by Tex Antoine. Some location filming was done in the Zoo and Aquarium, but the bulk of the material came from the Society's film library. Mr. Knobloch was asked to be coordinator for the show and assisted the television crew with the live shooting. The first show was aired on the evening of Saturday, December 3, on Channel 7. By the end of the year five shows had been completed.

DEPARTMENT OF EXHIBITION

Jerry M. Johnson, *Curator of Exhibition & Graphic Arts*

The past year was one of expansion, diversification and excitement for the Department of Exhibition. We expanded our facilities with the alteration of the old lecture hall into an exhibits preparation laboratory. We also expanded our staff with the addition of Mr. Sheridan Oman, a highly competent exhibits specialist. We diversified our operation by acquiring much needed shop equipment, which allows us to operate more independently as a department and more efficiently. We have adapted techniques used in other exhibition fields, such as casting from molds, and we have developed new techniques, particularly in model production, which allow us to present our ideas in a more comprehensive way.

World of Darkness

The year also produced the excitement and challenge of preparing for the opening of a major new building, the World of Darkness.

Models were prepared from sketches of the major exhibits to be housed in the nocturnal building, including a day-night exhibit, a desert scene, a tropical cave and flyway, and a leopard exhibit. Working from these models, full-scale mock-ups of cage interiors were developed out of fiberglass which, when finished, as some have been, were cut up into sections and stored until such time as we are able to reset them in the new building.

One exhibit in particular deserves special note and that is the theme-setting "Day-Night" display which will confront the visitor as he first enters the new building. The basic idea was to create a small scene which would house both a diurnal animal (a chipmunk) and a nocturnal animal (a flying squirrel) in a daylight setting, and then duplicate the exact scene to show the active-inactive behavior in the same area at night. The display was completed by making two casts from a single rubber mold which was taken from an area in the Zoological Park.

In addition to the exhibit work connected with the building, a great deal of time was spent designing the graphic material which will augment the live exhibits in the building.

MISCELLANEOUS PROJECTS

Another important project of the Department was the development of a model of the new bear dens complex. The model will be used by the building contractors as a working guide of what we hope to accomplish with that long-awaited display.

An attractive Prairie Dog exhibit was completed for the Children's Zoo. The exhibit was designed to allow visitors to view the animals both above and below ground.

Plans were developed and a model completed for the expansion of our present Sea Lion Pool. Unfortunately, this important project has been shelved for the present due to the uncertain plans concerning the future development of Baird Court.

One "experimental" project which didn't work was the development of a "termite nest" which was placed in the cage of Jimmy, the chimpanzee, at the Great Apes building. The idea was to follow up on Miss Jane Goodall's observations of chimps in the wild using "tools" to obtain termites from nests. Our homemade termite nest came complete with holes, straws for poking into the holes, and honey as reward for effort. Outside of using the straws to scratch his ears, Jimmy, who was about 12 years old when he came to the Zoo in 1945, failed to respond, but then a full stomach and a complacent attitude are not the best prerequisites in a situation of this kind.

The Department was called upon to design several printed pieces, including a membership promotional mailing, a brochure on summer courses for young people, a membership promotion sign for the Aquarium, a cover design for the *Annual Report*, a new cover format for *Animal Kingdom,* and a new cover design for the Aquarium Employee's Handbook.

Other graphic projects included the design of a new Zoo map, a Zoo poster, several graphic panels for the Annual Meeting at the Waldorf-Astoria, including a large panel for the Osborn Laboratories of Marine Sciences, a vanishing animal symbol, which we hope will become standard in zoos throughout the United States, the design of an appropriate symbol for the American Association of Zoological Parks and Aquariums, a cover design and revised editorial layout for the AAZPA Newsletter, the house organ of the American Association of Zoological Parks and Aquariums.

New educational graphics were completed during the year for Wolf Wood, Gibbon Islands, pelicans, the Takin, Père David's Deer, Crane Walk, Prairie Dog Town, and a sign explaining why the birds don't fly out of the open-fronted exhibts at the Aquatic Birds Building.

Background paintings were completed on three exhibits during the year. Two of these exhibits, "A Riverbank" and "Fishing Owls," are located in the Aquatic Birds Building; the other, a tropical rain forest scene, is located in the Mandrill cage at the Primate House. We have not as yet solved the problem of the Mandrills peeling off large portions of their tropical rain forest scene.

A very promising association was evolved with the Pratt Institute School of Architecture concerning their participation in numerous design problems unique to an organization of our size and scope. Visitor traffic, public seating, souvenir stands and general landscaping are a few of the areas which will be explored. It is expected that the results of this study will be published.

TRAVEL

Mr. Johnson attended the AAZPA meetings in San Diego and subsequently visited the Arizona-Sonora Desert Museum in Tucson. During November, Mr. Johnson attended the mid-winter meetings of the AAZPA in Washington, D.C.

CONSTRUCTION AND MAINTENANCE

CHARLES B. DRISCOLL, *Superintendent of Operations*
GEORGE RUSSELL, *Assistant Superintendent of Construction*
LOUIS SANDERS, *Assistant Superintendent of Maintenance*

ON JANUARY 10, 1966, a contract was signed for renovation of the former Farm-in-the-Zoo cow barn into a new Animal Behavior Laboratory. This signaled the start of a large physical improvement program in this area of the Zoo for the Institute for Research in Animal Behavior. Before the year was over new laboratories, a work shop, offices, animal quarters, and a 70-foot air dome were installed by outside contract and Park forces.

A smaller renovation was completed by transforming the old Lecture Hall, near the Rocking Stone area, into a work shop for the Department of Exhibition. The project included a new insulated ceiling, boiler room and heating plant, new windows, shutters, and electric and ventilation systems.

The old Giant Panda enclosure was modified for a Takin exhibit by providing new stalls, doors, and air conditioning in the animal shelter building. The outdoor moated area was prepared with gravel and a large tree trunk placed against the rock out-cropping.

The Wolf Wood exhibit, begun in 1965, was completed and opened in the summer.

In September, a Capital Budget project for the construction of a Bison Range in Lake Agassiz was started, but operations were suspended in the winter due to weather conditions. This project, the northern terminal of our North American exhibits area, will be completed in 1967 at a cost of $81,455.

Other projects performed by outside contract were the installation of a new oil-fired boiler in the Reptile House; installation of new oil burners in the African Plains Lion House, the Ostrich and Elephant Houses; laying of over 2,700 square yards of asphalt paving, and the installation of an animal crematory, the latter required by Federal regulation. A new bar-type cage front was installed in the Great Apes building and a new roof covering on the Yak House.

Park forces constructed three new islands in our lakes, one for water birds in Heart Lake and two for gibbons in Cope Lake, all heavily planted with trees and located for close public viewing. The outdoor otter exhibit was refurbished by exposing natural rock and planting hemlock. A new pool was formed in the burrowing rodents' cages and another for Pigmy Hippopotamuses in the Kangaroo House.

Installation of two deep freeze boxes adjacent to the Animal Cookroom involved foundation walls, ramps, and a concrete platform providing an additional 1,512 cubic feet for food storage.

Other important projects completed included:

Painting interior of the Animal Hospital, Yak House, work areas of Large Bird House, Lion House cages, interior of the cafeteria, kiosks, five service and souvenir stands, the Farm apartment, and 810 restaurant chairs and tables.

Installation of new electric service to the Pheasant Aviary.

Installation of de-icing systems in the Wild Fowl Pond and Wolf Wood moat.

Installation of time clocks for lighting control in Monkey House cages.

Installation of a new automatic mixing valve in Reptile House.

Renovation of the kitchen in the Service Building apartment.

Rebuilding African Plains bridge and installing a new roof on Asiatic Deer barn.

Building a Tractor Train booth at Bronxdale.

Building a Prairie Dog exhibit at Children's Zoo.

Repairs to the border fencing and new fence east of the Bronx River at the southeast corner of Park.

Installation of electronic counter for automobiles at Rainey Gate.

Repairs to Tractor Train coaches and mules.

Relocation of Tractor and Tiger Train terminals to area northwest of Cafeteria.

Winterizing eight Lion House dens and the outdoor Monkey House cages.

Installing a public address system on the Elephant House dome.

Construction of an ostrich shelter at the African Plains annex.

The Maintenance Department, in addition to working on our "home improvement" projects, carried out a large spring and fall landscaping program that included the planting of 143 trees, 1,749 shrubs and 2,351 vines and small plants. The largest planting was at the Great Apes moats, where old fencing was removed and a border of 320 yews and 22 summershade Norway Maples was planted.

FACILITIES DEPARTMENT

EDWARD KEARNEY, *Manager*

EDWARD QUINN, *Assistant Manager*

INCOME DERIVED FROM the Zoo's restaurants, animal rides and souvenirs is of vital importance, for it is this money which goes toward the purchase of animals and for general improvements in the Park. In 1966, the Facilities profits rose to $373,000 from $252,600 in 1965, and more than doubled the figure for 1964. These remarkable increases are not the result of substantial gains in gross sales; for instance, sales were up only $87,588 over 1965. Rather, the answer comes from the continuation of a program to produce a more efficient operation.

The Zoo realized a $77,447 profit on a gross sale of souvenirs of $195,586. The figures for the previous year were $55,966 and $160,966. A change-over from a food-to-order system to a pre-packaged operation at the African Terrace Restaurant produced better than a 50% increase in profits, while the gross sales were only up some 12%. This facility also discontinued the practice of selling food tickets in favor of the speedier cash-over-the-counter system.

PERSONNEL

During the year, this department was faced with a very tight personnel problem with six fewer permanent employees on our roster. Nevertheless, we believe the work was accomplished and most of our customers satisfied, thanks in no small part to the loyalty and cooperation of the permanent employees and those seasonal employees who come back every spring.

Late in the year, we lost the services of Maude Willoughby who retired after a 24-year career which she began as a cashier and ended as a clerk in the department.

MISCELLANEOUS OPERATIONS AND SERVICES

CHILDREN'S ZOO. This facility completed its 26th year in operation with better than a 6,000 increase in attendance over the previous year. The total admissions for 1966 were 324,267.

RIDING TRACK. 1966 showed a substantial decrease in the number of rides, reflecting an increase in price from 20 to 25 cents. The total was 261,720, down by over 60,000 from the previous year.

TIGER TRAINS. The Tiger Trains again gave over 30,000 rides during their operation from late spring to early fall.

THE AQUARIUM

REPORT OF THE DIRECTOR

Ross F. Nigrelli, *Director*

Two developments of major importance to the Aquarium and to the Society in 1966 were the acquisition of West 8th Street from the City of New York, the approval for which came as a result of the unanimous action of the Board of Estimate on September 22, and the development of a new concept for the expansion of exhibition, research, maintenance and other facilities. The latter is a long range land use plan calling for the elimination of parking within the present Aquarium grounds that extend from the easterly border of West 8th Street to West 5th Street, an area of approximately 15 acres. All new structures to be built in the future will be distributed in this area in a park-like atmosphere, with the present blacktop to be replaced with grass, trees, dunes, and beach plantings. Parking will be restricted to the newly-acquired West 8th Street, which will be consolidated with the extensive and valuable property on the westerly side of the street that was a gift to the Society from Trustee Laurance Rockefeller in 1964.

1966 was one of our most active years since the Aquarium first opened in June, 1957. The summer season was initiated with the Society's Annual Spring Members' Day Party on June 15, which was attended by 1,800 members and guests. Our attendance figures showed a 10% increase over 1965. This increase was due, in part, to the fact that we remained open on Mondays and Tuesdays during the fall and winter months. In previous years, the Aquarium was closed on these days for maintenance purposes.

In preparation for the spring party and for the summer season, the grounds and buildings, interior and exterior, were reconditioned and redecorated. Several renovations and innovations were also put into effect. The main exhibit hall was carpeted with an all-weather rug that improved the decor and helped to dampen some of the normal noise made by enthusiastic children. In addition, new instructive labels, with color transparencies for easy identification of specimens on exhibition, were introduced. Special exhibits showing commensal and symbiotic relations between fish and between fish and invertebrates were also developed as part of our new program to show ecological groupings or specific characteristics of fishes. The cold-water exhibition tanks and the warmer schooling fish tank were completely enclosed to prevent freezing or lowering of the water temperatures during the winter months.

AQUARIUM OPERATIONS

Robert A. Morris, *Associate Curator*

Guido Chibas, *Associate Superintendent*

Lars O. Mellkvist, *Assistant Superintendent*

Jewell Bungay, *Business Manager*

Charles Young, *Animal Manager*

During the summer, another nice collection of marine life was made in Bermuda in cooperation with Trustee Dr. Clay Frick. A total of 40 species and 275 specimens of fish and invertebrates were brought back to the Aquarium.

Our 30,000-gallon outdoor fish exhibit was enhanced by the addition of many of the Bermuda fishes. Aquarium personnel added a school of 150 Atlantic Mackerel to the tank, the fish caught by barbless hook and line from Steeplechase pier nearby. An "old boat wreck" was placed in the tank for effect and as cover for the fish. Later in the year a three-foot Sawfish was obtained through an exchange with Sea Arama in Galveston, Texas.

The Aquarium staff made several excellent collections of local fish during the summer months. These collections were obtained by our own seining efforts and through the cooperation of the commercial pound-net fishermen at Sandy Hook, New Jersey.

Exchange of specimens with other organizations is an important part of the operation and, during 1966, we exchanged specimens with the Steinhart Aquarium in San Francisco; Marineland of the Pacific, Los Angeles; the Calgary Aquarium in Canada; the Dallas Aquarium; the John G. Shedd Aquarium in Chicago, and Aquarama in Philadelphia.

Cooperation was continued in supplying live specimens to scientific organizations conducting research on marine animals. Our local killifish, puffers and dogfish sharks were in greatest demand.

MAMMALS

Walruses are extremely difficult animals to maintain in captivity, the first three years being the most critical. Self-inflicted tusk erosion, complicated by disease, is one of the main killers. "Sapiunuk," our three-year-old, 1,000-pound female, was in poor health early in the year, and so formula feeding was resumed at the suggestion of one of the keepers. This feeding, combined with her transfer to a tank with better water circulation, apparently suppressed the tusk complications.

The death of "Olaf," our 3,000-pound male Atlantic walrus was a tragic and great loss. Olaf had been with the Aquarium for slightly over 10 years, second only to an 11-year longevity at the Copenhagen Zoo. Death was caused by an acute volvulus, or twisting of the small intestine. This twisting induced regurgitation with consequential aspiration of the food.

Several new Alaskan seals were added to outdoor exhibits, among them the Ringed Seal, *Pusa hispida*, smallest of the pinnipeds, and the North Pacific Harbor Seal, *Phoca vitulina largha,* which closely resembles our Atlantic Harbor Seal.

One of our cantankerous male sea lions was donated to a Texas oceanarium; the remaining male and two females are doing better since his departure.

ATTENDANCE AND FACILITIES

Monthly attendance at the New York Aquarium for 1966 was as follows:

January	7,241	July	57,277
February	15,766	August	63,770
March	18,812	September	26,602
April	34,844	October	25,058
May	39,163	November	22,919
June	40,291	December	12,371

TOTAL: 364,114

During the year the Aquarium was visited by some 66,700 children in school and other organized groups, the former admitted free and the latter at reduced rates.

All facilities, which include the Parking Lot, Souvenir Shop and Restaurant, showed an increase in income over 1965.

PUBLICATIONS

DR. NIGRELLI

Enzootics in the New York Aquarium Caused by *Cryptocaryon irritans*

Brown, 1951 (=*Ichthyophthirius marinus* Sikoma, 1961), a Histophagus Ciliate in the Skin, Eyes and Gills of Marine Fishes. *Zoologica,* 51 (3): 97-102. (With G. D. Ruggieri, S.J.).

DR. STEMPIEN

An Antibiotic Substance Isolated from a Sponge of the Genus *Agelas. American Zoologist,* 6 (3): 363.

DR. RUGGIERI

Effects of Extracts of the Sea Star, *Acanthaster planci,* on the Developing Sea Urchin. *American Zoologist,* 6 (4): 592-3. (With R. F. Nigrelli).

Animalization of *Arbacia punctulata* Larvae by Extracts of the Sea Cucumber, *Holothuria edulis. American Zoologist,* 6 (4): 593. (With R. F. Nigrelli).

DR. GOLD

The Role of Ciliates in Marine Ecology. I. Isolation and Cultivation of a Member of the Order Tintinnida. *American Zoologist,* 6 (4): 513.

DR. JACOBS

Organization of the "Rhinencephalon" in the Bottlenose Dolphin, *Tursiops truncatus. Anat. Rec.,* 154: 361.

Features of the Surface Configuration, Blood Supply, Ventricular System, Rhinencephalon, Thalmus and Cortical Cytoarchitectural Patterns in the Brain of the Dolphin, *Tursiops truncatus. Anat. Rec.,* 154: 503. (With P. J. Morgane, W. L. McFarland, S. J. Piliero, and P. I. Yakovlev).

Gross Structure of the Ear, Nasal Cavity and Paranasal Sinuses of the Chimpanzee. *Anat. Rec.,* 155: 77-88. (With E. L. House, B. Pansky, and B. M. Wagner).

DR. GOREAU

Evidence for a Soluble Algal Factor Produced by the Zooxanthellae of *Tridacna elongata* (Bivalvia, Tridacniidae). In Proceedings of the International Conference on Tropical Oceanography. G. Thorson and F. Kozcy, Ed. (With N. I. Goreau and C. M. Yonge).

Sponge: Effect on the Form of Reef Corals. *Science* 151: 343-44. (With W. D. Hartman).

On the Predation of Coral by the Spiny Starfish *Acanthaster planci* (L.) in the Red Sea. Israel South Red Sea 1962 Expedition Rep. 2, 23-26.

Pleistocene and Holocene Geology of the Island Shelf near Kingston, Jamaica. *Marine Geology* 4 (3): 207-225. (With Kevin Burke).

DR. RAY

The ecology of Antarctic Seals. Antarctic Journal of the United States, July-August.

Analysis of underwater *Odobenus* calls with remarks on the development and function of the pharyngeal pouches. *Zoologica,* 51 (3): 103-106. (With W. E. Schevill and W. A. Watkins).

Stalking seals under Antarctic ice. National Geographic Magazine, 129 (1): 54-65.

Snooping on seals for science in Antarctica: Animal Kingdom, 66 (3): 66-75.

Dr. Kallman

Permanent survival of fine transplants among wild-caught fish of the genus *Xiphophorus*. American Zoologist, 6 (4): 533.

Dr. Schreibman

Freshwater survival after hypophysectomy in teleosts. *American Zoologist*, 6 (4): 517. (With Klaus D. Kallman).

Hypohysial cysts in a teleost fish. *J. Exp. Zool.* 162: 57-68.

Endocrine control of freshwater tolerance in teleosts. *Gen. Comp. Endocrinol*, 6: 144-155. (With K. Kallman).

Dr. Fried

Alpha-glycerophosphate dehydrogenase and glucose-6-phosphate dehydrogenase activities in teleosts. *American Zoologist*, 6 (4): 578.

Dr. Baslow

N-acetyl-histidine synthetase activity from the brain of the killifish, *Fundulus heteroclitus*. *Brain Research*, 3: 210-213.

Personnel

There were several major changes in the staff during the year. Aage Olsen, our Superintendent since 1956, retired in February and is now living in Florida. Mr. Paul Montreuil and Dr. Joseph Geraci resigned as Director and Curator, respectively, to take the same positions at the new Montreal Aquarium under construction for Expo 67. Mr. Guido Chibas resigned as our Associate Superintendent and is now employed with an electrical company in Florida. Dr. Carleton Ray resigned as Curator and was appointed a Field Associate.

Under a grant from the New York Zoological Society, Dr. Ray did research in the northern Bering Sea in May on the acoustics of the walrus and the Bearded Seal. In June, he attended meetings of the American Society of Mammalogists in Long Beach, California.

Dr. Ray also continued his studies on the Weddell Seal of Antarctica during October and November under a grant to the New York Zoological Society from the National Science Foundation.

Mr. Robert Morris, former Curator of Fishes at Marine Studios in Florida, joined our staff on April 1 as Associate Curator, and Mr. Lars Mellkvist was appointed Assistant Superintendent in November, 1966.

Dr. Nigrelli was honored in May by New York University and the New York University Alumni Federation on his 25th anniversary as a member of the faculty of the Graduate School of Arts and Science, and he attended the meetings of the American Association of Zoological Parks and Aquariums at San Diego in February.

LABORATORIES PERSONNEL

In January, Drs. Jacobs, Gold and Cecil joined the staff of the Department of Marine Biochemistry and Ecology, which was further augmented in June by the return of Mr. Vincent Liguori. Miss Anne O'Melia also joined the staff in June as a technical assistant, while Mr. Ferrucio Paolini started work in the same capacity in November

In February and March, Dr. Nigrelli attended meetings of the President's Scientific Advisory Committee's Panel on Oceanography, which issued a report recommending an intensive and accelerated national program in oceanography.

Dr. Nigrelli gave a lecture on drugs from the sea to the scientific personnel of Geigy Pharmaceuticals, Yonkers, New York, in February, and was chairman of a session on marine biotoxins at the International Symposium of "Biotoxins" held by the International Society of Toxinology in April at Atlantic City. In June, he was appointed chairman of an advisory committee of the Caribbean Research Institute, College of the Virgin Islands, to consider the possible development of an ecological laboratory on the Island of St. John's. In company with Dr. Gold, he attended a symposium on "The Ecology of the Hudson River" held at the Oncheota Conference Centre, Sterling Forest, N. Y., where he was chairman of the biology section. They also attended a discussion group-site visit to study the feasibility of the establishment of an oceanographic center at Montauk, Long Island.

In October, Drs. Ruggieri and Stempien and Mr. Liguori attended a seminar on gel electrophoresis techniques at the E. C. Apparatus Co. in Philadelphia. Dr. Stempien attended the Eastern Analytical Symposium in November. This was sponsored by the New York Section of the American Chemical Society. Dr. Gold visited Ohio State University to collaborate on a program for the electron microscope study of the loricae of Tintinnids.

In March, Dr. Goreau attended a conference in London on "Fossil Clocks" sponsored by the Royal Astronomical Society, where he presented a paper on coral calcification and the formation of "diurnal" bands on the epitheca. In August, he attended the annual conference of the Association of Island Marine Laboratories of the Caribbean in Barbados. He gave a paper on gigantism and abundance of bentic forms in Jamaican reefs.

An expedition was made during the year to northern Guatemala and British Honduras by Dr. Kallman. In Guatemala, he enjoyed the cooperation of Mr. Robert Dorion of El Salto, Guatemala City, who is a member of the Society and takes great interest in its research activities. The expedition was highly successful in that a large number of new pigment genes of *X. maculatus* were discovered. These fish also provided additional evidence that in this species each population has evolved its own pigmentary system.

Dr. Kallman also attended meetings of the 7th International Transplantation Conference in New York; the AIBS meeting at College Park, Maryland; the Centennial celebration at Peabody Museum, New Haven, and the A.A.A.S. meeting in Washington, D.C.

Dr. Schreibman attended the AIBS and A.A.A.S. meetings.

COLLABORATORS AND THE NATURE OF THEIR COLLABORATIONS WITH THE NEW YORK AQUARIUM

DR. PETER ABRAMOFF, Marquette University, Milwaukee, Wisconsin. Gynogenesis in *Poecilia formosa.*

DR. EUGENE AGALIDES, General Dynamics/Electronics, Rochester, N. Y. Effects of drugs on electric fishes with relation to temperature adaptation.

DR. WILLIAM ANTOPOL, Director, Pathology Department, Beth Israel Hospital, New York. Diseases and pathology of cetaceans and other marine mammals.

DR. JAMES W. ATZ, American Museum of Natural History, New York. Genetics of *Xiphophorus.*

DR. JOHN N. BALL, University of Liverpool, England. Pituitary of poeciliids.

DR. ION O. COCIOBA, Beth Israel Hospital, Microbiology of pinnipeds.

DR. HARRY CHARIPPER, Department of Biology, New York University. Comparative Histology of Fishes.

DR. REZNEAT DARNELL, Marquette University, Milwaukee, Wisconsin. Gynogenesis in *Poecilia formosa.*

DR. R. ENDEAN, Department of Zoology, University of Queensland. Studies on toxic Australian seastars.

ERWIN ERNST, M. S. Chairman, Department of Biology, Setauket High School, Long Island. Sub-aqua expert. Starfish distribution and ecology.

DR. FRANCIS H. FAY, Arctic Health Research Center, Anchorage, Alaska. Temperature regulation, nutrition and growth of walruses.

ELMER T. FELTZ, Arctic Health Research Center. Microbiology and virology of pinnipeds.

DR. HAROLD FINK, Director of Laboratories, Coney Island Hospital. Pathology of marine animals.

DR. GEORGE H. FRIED, Beth Israel Hospital. Enzymology of pinnipeds and fishes.

DR. KURT GERSTMANN, Staff Pathologist, Coney Island Hospital. Pathology of marine animals.

PETER R. GIMBEL, New York, N. Y. Diving-photography in Antarctica.

DR. ELI GOLDSMITH, New York University Dental College. Effects of marine biotoxins on various biological systems.

DR. ALBERT S. GORDON, Department of Biology, New York University Graduate School of Arts and Science. Comparative hematology.

DR. ROBERT W. HARRINGTON, JR., Entomological Research Center, Vero Beach, Florida. Hermaphroditic *Rivulus.*

Dr. Milan J. Kopac, Department of Biology, New York University Graduate School of Arts and Science. Cyto-and-histochemistry of melanomas in platyfishes.

Dr. William J. Kuhns, Department of Pathology, New York University School of Medicine. Comparative Serology of fishes.

Lt. David O. Lavallee. Underwater technology and sound production of pinnipeds.

Dr. L. Edgar Lee, Department of Pathology, Yale University. Diseases of fishes, generally; electron-micrographic studies of trout liver tumors and papillomas in the Bahamian slippery dick.

Dr. John J. A. McLaughlin, Haskins Laboratories, New York. Pharmacological studies on dinoflagellate toxins.

Dr. William Medway, Department of Clinical Pathology, University of Pennsylvania, School of Veterinary Medicine. Blood Studies in Cetacea.

Dr. Robert R. Miller, Museum of Zoology, University of Michigan, Gynogenesis in fishes.

Dr. Gustavo Pulitzer, Portofino, Italy. Collection and identification of sponges.

Dr. Ellen M. Rasch, Marquette University, Milwaukee, Wisconsin. Gynogenesis in *Poecilia formosa.*

Dr. Donn E. Rosen, American Museum of Natural History, New York. Genetics and evolution of *Xiphophorus.*

Professor Michele Sara, Director of the Institute of Comparative Zoology, University of Bari, Italy. Collection, identification and biochemistry of sponges.

William E. Schevill, Woods Hole Oceanographic Institution. Bioacoustics of marine mammals.

Dr. R. Jack Schultz, Department of Zoology, University of Connecticut. Gynogenesis in fishes.

Miss Edna Stein, Senior Bacteriologist, Coney Island Hospital. Microbiology of marine animals.

Dr. Horace Stunkard, American Museum of Natural History. Protozoan and helminthic parasites of fishes and marine mammals.

Dr. Henry Vogel, Bureau of Laboratories, Department of Health, New York. Continuation of research on Salmonella and other terrigenic disease-producing bacteria in fishes and in marine mammals.

Dr. William A. Watkins, Woods Hole Oceanographic Institution. Bioacoustics of marine mammals.

GRADUATE STUDENTS

NEW YORK UNIVERSITY GRADUATE SCHOOL OF ARTS AND SCIENCE

Ph. D. Candidates

Erwin Ernst, ecology, distribution and environmental behavior of the star fish, *Asterias forbesi* (Desor) and *Asterias vulgaris* Verrill in the littoral zone waters of Long Island.

George C. Hill, structure and function of the Mitochrondria in *Crithidia fasciculata.*

Betty Jane Lasley, effects of holothurin on leucocyte motility and phagocytic activity.

Vincent R. Liguori, a comparative study of bacterial extracts by zone electrophoresis on polyacrylamide gels, with special reference to the marine pseudomonad, *Pseudomonas piscicida,* an ichythotoxic species.

Joseph F. Sayegh, experimental steroidogenesis in fishes.

Mathew Shallet, endocrine control of limb regeneration in male fiddler crabs.

Peter Squicciarini, experimental studies on inflammatory reactions in fishes.

George F. Wendt, studies on tissue mix in the branchial arches of fishes.

Fordham University, Graduate Department

Ph. D. Candidate

Norman F. Cates, studies on interrelated metabolism of Zooxanthellae and the tissues of sea anemones.

Master of Science Candidates

Jonathan E. Amson, the effects of increased pressures of nitrogen on certain teleosts.

Harry A. Birnbaum, M. D., the fish adrenal cortical homolog and preliminary studies in experimentally induced arteriosclerosis.

Robert Ferone, folate cofactor biosynthesis by *Plasmodium bergagi*. Comparison of folate and dyhydrofolate substrates (M.S. dissertation published 1966).

William G. Lillis, larval helminthic parasites of fishes and their experimental transmission in birds and mammals.

Graduate Students-in-Training

Chung, Paul	New York University
Fay, Florence	C. W. Post College, Long Island University
McGinn, Marian Patricia	Fordham University
O'Melia, Anne F.	Fordham University
Seifert, George	New York University

RESEARCH AND REPORT OF THE LABORATORIES

Aquarium Laboratory and Staff Research. Ross F. Nigrelli, *Pathologist and Director of Research;* Robert A. Morris, *Associate Curator;* Carleton Ray, *Field Associate;* Dr. William Antopol, *Beth Israel Hospital, Research Associate in Comparative Pathology;* Dr. Harry A. Charipper, *Research Associate in Histology;* Johanna van de Kerkhoff, *Technician.*

With the exception of the volvulus that caused the loss of Olaf, no new causes of death were encountered. The demise of the Weddell and Crabeater seals from McMurdo Sound, Antarctica, were due to profound physiological causes, the inability of the animals to accommodate to changes in their circadian rhythm.

Three Humboldt Penguins died, one from injury of unknown origin. No obvious pathological lesions were seen in the other two.

Most of the fishes that died were newly-arrived specimens, shipped from long distances. Many died from shock; some arrived heavily infected, while others, because of their low resistance, became infected soon after arrival. Deaths from common aquarium parasites and other infectious agents were kept at a minimum, due to preventative measures. For the first time in the long history of the Aquarium, no deaths were caused by *Benedenia melleni,* the ubiquitous monogenetic trematode that has been a constant aquarium problem.

As is our custom (in collaboration with Dr. P. M. Powles, Fisheries Research Board of Canada), studies were initiated on Epizootics of Ichthyosporidiosis in Yellow-tail Flounders *(Limanda ferruginea)* from the North Atlantic. This is a highly infectious fungal disease that may be of extreme economic importance to the Canadian fishery industry.

Laboratory of Marine Biochemistry and Ecology. Ross F. Nigrelli, *Director of Research;* Martin F. Stempien, Jr., *Senior Investigator and Research Associate;* George D. Ruggieri, S. J., *Research Associate;* Myron S. Jacobs, *Research Associate;* Kenneth Gold, *Research Associate;* Jack T. Cecil, *Research Assistant;* Vincent Liguori, *Research Assistant;* Norman Cates, *Research Assistant;* Ferruccio Paolini, *Technical Assistant;* Anne O'Melia, *Technical Assistant;* Freda Slavin, *Technical Assis-*

tant; Patricia McGinn, *Technical Assistant;* E. L. Bohm, *Special Research Assistant;* Paul Chapman, *Research Assistant and Sub-Aqua Expert.*

During 1966, the greater part of the construction of the Osborn Laboratories of Marine Sciences was completed. It had been hoped that we would be able to move into the new laboratories during the latter part of the year, but a plumbers' strike in August and September slowed down the construction schedule sufficiently so that a move into the new building could not take place before January, 1967.

July marked the activation of the first part ($25,000) of a $75,000 equipment grant from the Rockefeller Foundation. The funds were used to purchase radioisotope monitoring equipment for the new laboratory.

Research was continued under the auspices of a grant from the John A. Hartford Foundation, Inc., on pharmacologically active compounds derived from marine organisms. In connection with this study, Drs. Stempien and Ruggieri made a trip to Jamaica, West Indies, in June. Here, in addition to collecting specimens of sponges and echinoderms, they consulted with Mr. Paul Chapman, our sub-aqua collector, about furnishing material from different areas of the island. Mr. Chapman, with the help of his wife, Dr. Rosemary Chapman, has collected, prepared, and shipped many specimens of sponges, sea urchins, crinoids, sea cucumbers, sea stars, and brittle stars to our laboratory for physiological testing. These studies, directed by Dr. Stempien, have shown the almost 30% of all sponges investigated show either antibiotic or toxic properties.

Work also continues on elucidation of the structure of the antibiotic substance present in a number of species of sponges of the genus *Agelas*. Mr. Lothar Bohm of the University of the West Indies has processed large quantities of these and a number of other sponges, which showed a very strong antibiotic action, in order to facilitate the isolation and characterization of the substances present. Mr. Bohm did the research in our laboratories.

The isolation of a number of new echinoderm toxins was accomplished by Dr. Ruggieri and his group this year. These were obtained from the Pacific sea star *Acanthaster planci* (crown of thorns), the Hawaiian cucumber *Holothuria edulis*, and the two synaptid cucumbers *Orpheodesoma spectabilis* from Hawaii and *Euapta lappa* from Jamaica. Further physiological testing of these toxins is under way. In addition, we were able to obtain large quantities of the basket star *Astrophyton muricatum* from Florida. A small amount of material was isolated from this animal which proved toxic to killifish.

Studies were undertaken this year by Dr. Cecil to evaluate the cytotoxicity of a number of our echinoderm toxins toward oral carcinoma (KB) cells grown in tissue culture. Rather striking results were obtained, indicating all of these materials to be cytotoxic in varying degrees at very low concentrations. These studies are being extended to include all of our physiologically-active materials. In addition, attempts are being made to start tissue culture lines of invertebrate cells. These will be used to further study the physiological activity of materials which we isolate from marine organisms. It is hoped that such studies will give us more information on the mechanism of action of these toxins in the marine environment.

Dr. Myron S. Jacobs moved his cetacean brain laboratory into our facilities this year. For the last three years, he has been engaged in a collaborative project with Drs. P. J. Morgane and W. McFarland of the Communications Research Institute, Dr. S. J. Piliero of Geigy Research Laboratories, and Dr. P. L. Yakovlev of Harvard Medical School to develop a comprehensive atlas of the brain of the Bottlenose Dolphin, *Tursiops trucatus.* This will treat the cetacean nervous system from the comparative point of view, and, in addition, is expected to lay the foundation for future behavioral studies in whale-forms. In transferring his laboratory to the Aquarium, he thought he would be better able to interpret research findings from his own material, with regard to neural structure, with the wide range of behavioral activities observable in the variety of aquatic mammals on display at the Aquarium.

Dr. Kenneth Gold, whose research centers around the isolation and cultivation of marine microorganisms, has isolated and maintained *in vitro* a species of arenaceous tintinnid protozoa since June. This is the first record of the *in vitro* cultivation of this important group of marine protozoans—the only ciliates, in fact, which are known to leave a fossil record. Preliminary electron microscopy of lorica or "shell" of this animal has been accomplished in collaboration with Dr. Robert F. Pfister of Ohio State University.

Dr. Gold's other interest, factors which affect the stability of thiamine in sea water, has also yielded new results. The temperature dependent destruction of thiamine in sea water was found to be retarded by the addition of a number of substances: naturally-occurring amino acids, nucleotides, and citric acid. These studies are important because of the crucial role played by thiamine in the marine environment. The "fertility" of the waters, in any given location, may be determined by its presence or absence.

Mr. Norman Cates has been actively engaged in studies aimed at elucidating the relation of zooxanthellae with their host coelenterate. Using the sea anemone, *Condylactus* sp., he has investigated the absorption and excretion of a number of biologically important anions, phosphate, nitrite and nitrate, in the presence and absence of light. He expects to extend these studies using isotopically-labeled compounds as substrates. The results of these studies will be submitted to Fordham University in connection with his doctoral program.

While preparing large quantities of sponge extracts, Mr. Lothar Bohm continued his research on factors involved in the mechanism of calcification in the calcereous alga *Halimeda opuntia.* Preliminary studies on the inorganic ion balance of dried algae showed an excess of cations. By use of Ca^{45}, the excess calcium was found bound to an organic fraction. Purification of this material, by means of electrophoresis and molecular sieve chromatography, yielded a fraction which specifically bound calcium and was shown to be an acidic mucoprotein. Further characterization of this material is in progress. This research will be submitted by Mr. Bohm to the University of the West Indies as a partial fulfillment of the prerequisites for the M. S. degree.

Laboratory of Fish Genetics. KLAUS D. KALLMAN, *Principal Investigator;* JUDITH S. KALLMAN, *Laboratory Manager;* MARTIN P. SCHREIBMAN, *Research Associate in Fish Endocrinology;* HENRIETTA KAZAN, *Laboratory Technician;* CORNELIUS MUNIC, *Animal Caretaker.*

Pigment Cell Study. Several important discoveries were made during the last year. The complex pigment locus of the platyfish, *Xiphophorus maculatus,* which is closely linked to the gene controlling sex determination, consists of at least three major genes. One of them controls black pigment patterns composed of macromelanophores, a second is concerned with red and yellow patterns composed of erythrophores, and the third gene controls eye pigmentation. According to our genetic tests the first two genes can be further divided into several sub-units, since rare cases of intragenic crossovers have been discovered.

When the macromelanophore and erythrophore genes of *X. maculatus* are introduced through hybridization into other species of *Xiphophorus,* their expression becomes greatly enhanced, often resulting in melanomas and erythrophoromas. Since these fish tumors closely resemble those of man, they have been studied in great detail for many years. Most significantly, we have now established that the development of pigment cell abnormalities is not restricted to interspecific hybrids, but also arise within the pure species when the pigment genes of one population are introduced into another. At the present time, 17 macromelanophore alleles have been identified in *X. maculatus.*

Another important discovery was that pigment cell abnormalities develop when a pigment allele assumes a different position within this complex locus due to intragenic crossovers. The *Sd* (spotted dorsal) gene of strain Jp 163 A has been studied in this laboratory since 1939 for 35 generations. All platyfish with this gene have a few harmless macromelanophores in the dorsal fin. But in 1966 one exceptional fish appeared in which the entire fin was melanotic. Breeding experiments established that the gene had assumed a new position on the chromosome and that this change was stable and heritable. That the expression of a pigment gene depends upon its exact location on the chromosome is reminiscent of conditions found in several other organisms in which regulator and operator genes are sometimes found in close proximity to the structural (macromelanophore) gene. In man certain cancers are also thought to be caused by gene and chromosome mutations.

Sex Determination Study. In fishes of the genus *Xiphophorus* many different types of sex determination exist and have puzzled biologists for a long time. Since in some species, e.g. the swordtail, *X. hellerii,* sex ratios are highly variable, sex determination was considered primitive, perhaps influenced by environmental factors. Sex chromosomes, when present, were thought to be of relatively recent origin.

We have now obtained evidence that strongly suggests that the ancestral form, which gave rise to all other species of *Xiphophorus,* had an XX-XY mechanism, still present today in *X. milleri, X. variatus,* and some populations of *X. maculatus* and *X. montezumae.* Homology of the sex chromosomes of three of these species has been established. In *maculatus* sex determination has evolved one step further. A new chromosome, W, has arisen that acts like a strong X. In many populations of *maculatus* there are three types of females (WY, WX, XX) and two types of males (XY, YY); in others all females are XX and males XY: apparently there is no population from which the X is absent. For many years fish of the Belize River were thought to be WY-YY, but during our 1966 expedition fish with the X chromosome were finally discovered.

Since the W chromosome probably has recently arisen and is now widespread, a definite advantage must be associated with it. The data from our 1966 collections of Belize River platyfish provide a clue to the abundance of the W. In populations with the XX-XY system pigmented females and males occur in equal frequency, but in the Belize River where the X is very rare, the percentage of pigmented males is twice that of pigmented females. We have analyzed over 2,000 young produced by 35 wild-caught WY females, but not one female offspring inherited the allele of the female parent. Every color gene was located on the Y chromosome. It thus appears that in natural populations there does not exist any marked W chromosome. In our laboratory, however, pigment genes have crossed over from the Y to the W several times during the last 10 years. The net effect of an unmarked W chromosome in natural populations is, of course, that females are less highly pigmented and, therefore, more cryptic and better protected from predators. This also holds true for drab-colored males, but those with a combination of bright colors may have a decided advantage during courtship or in territorial defense. Since pigment genes are present on the X chromosome, XX females may be at disadvantage and selectively eliminated. All these possibilities can be tested in the laboratory. We have here a striking example of how such diverse fields as behavior, ecology, oncology and genetics are interrelated.

Endocrinology. Dr. Schreibman has now extended the study of hormonal control of freshwater tolerance to 17 species of teleosts. Based on investigations within two families (Cyprinodontidae and Poeciliidae) the data suggest that in the Atheriniformes the pituitary gland is essential for freshwater survival. There is some evidence that prolactin or a prolactin-like substance is the hormone that is responsible for freshwater survival.

In one of our inbred stock of platyfish, strain Gp from the Rio Grijalva, which has been maintained in the laboratory since 1952 for more than 20 generations, a high percentage of fish with abnormal gonadal differentiation was observed during the last three years. Dr. Schreibman discovered that the pituitary glands of these fish have cysts lined with typical goblet cells. The accumulation of their secretion accounts for the abnormal enlargement which is characteristic for such glands. The origin of the cysts appears to have a polygenic basis and perhaps arose as a result of inbreeding.

This pituitary abnormality can be considered an *inborn developmental error.* In fish the goblet cells that line the pharyngeal cavity and the cells of the pituitary gland have a common embryological origin. Cysts result when cells of the developing gland fail to differentiate into pituitary cells, but become goblet cells instead. When cysts are located in regions of the pituitary gland that produce gonadotrophic hormones, abnormal gonadal development usually occurs.

Dr. George H. Fried, Brooklyn College, together with Dr. Schreibman, has begun a study of the effects of hormones on lipid metabolism in fish. This investigation was prompted by observations that hypophysectomized platyfish that have pituitary grafts or receive prolactin injections show large deposits of body fat.

Physiology and Ecology of Coral Reefs. Thomas Goreau, *University of the West Indies, Jamaica, Principal Investigator;* Nora I. Goreau, *Research Associate;* Dr. Rosemary Ashby, *Research Assistant in Marine Biology;* E. L. Bohm, *Research Assistant in Marine Chemistry;* Eileen Graham, *Research Assistant in Marine Phycology;* Y. Neumann, *Research Fellow in Marine Biology and Biochemistry;* Judith C. Lang, *Visiting Pre-Doctoral Fellow;* Ross F. Nigrelli, *Consultant.*

The Coral Reef project continues to be supported by grants from the National Science Foundation and the National Institutes of Health, under the auspices of the New York Zoological Society. In addition, the University of the West Indies, co-sponsor of the project, holds a research contract with the Office of Naval Research.

During the last 18 months, a small marine station has been installed at Puerto Seco on the north coast of Jamaica on property loaned to the University by the Kaiser Bauxite Company. This station is equipped primarily for underwater research on coral reefs and has facilities for diving, including compressor and recompression chamber. Running sea water is available for keeping live specimens. Recently, the Wolfson Foundation has made a grant-in-aid for the construction of a permanent marine station on the north coast.

Other research projects worked on or begun during 1966 include the following:

1. *Fungiacava:* a new family and genus of coralphilous bivalves. (With N. I. Goreau, C. M. Yonge, T. Soot-Ryen, Y. Neumann and V. Safriel).
2. Symbiosis of *Tridacna* with Zoozanthellae. (With N. I. Goreau and C. M. Yonge).
3. On *Ceratoporelle:* a new class of sponges, and a representative of an order of ancient reef-builders believed to have been extinct since upper Mesozoic times. (With N. I. Goreau, W. D. Hartman and F. M. Bayer).
4. Description of new species of algae belonging to the genus *Halimeda.*
5. Taxonomy and ecology of the Jamaican shallow water Schleractinian corals. (With J. W. Wells).
6. Sediment production and translocation in coral reefs. (With J. L. Sanders and R. F. Dill).
7. Pleistocene and Holocene geology of the Jamaican coral reefs.
8. The nutritional relationship of Zoantheria of the genus *Zoanthus* with zooxanthellae. (With C. von Holt, Y. Neumann and N. I. Goreau).

Marine Fouling Laboratory, U. S. Naval Applied Science Laboratory. ARNOLD FRIEBERGER, *USASL Materials Engineer, Material Sciences Division;* CHRISTOPHER COLOGER, *USASL Materials Engineer;* HAROLD HORBUND, *USASL Chemist;* GEORGE SEIFERT AND PAUL CHUNG, *Technical Assistants;* ROSS F. NIGRELLI, *Director, Osborn Laboratories of Marine Sciences, Consultant.*

The development of techniques for the maintenance of large numbers of barnacles of several species in various stages of development which have made it possible to study various factors that may be critical for the fouling phenomenon is being continued.

Census of the Aquarium, December 31, 1966

		Species & Subspecies	*Specimens*
Phylum Chordata			
Class Chondrichthyes-Sharks, Rays and Chimeras			
Orders			
Squaliformes	Sharks	4	14
Rajiformes	Rays, skates	6	17
Class Osteichthyes-Bony Fishes			
Orders			
Acipenseriformes	Sturgeon	1	3
Clupeiformes	Tarpon, Herrings, bonefish	3	9
Cypriniformes	Catfishes, minnows	3	4
Anguilliformes	True eels	2	3
Cyprinodontiformes	Killifishes	1	20
Gadiformes	Codfishes, etc.	2	6
Gasterosteiformes	Sticklebacks, pipefishes seahorses, etc.	3	32
Beryciformes	Squirrelfishes, etc.	3	10
Perciformes	Perch-like fishes	88	567
Pleuronectiformes	Flatfishes	3	29
Tetraodontiformes	Trunkfishes, Trigger fishes, puffers, etc.	7	9
Batrachoidiformes	Toadfishes	1	8
Dipnoi	Lungfishes	1	1
Ostariophysi	Piranha	2	4
Class Reptilia—Reptiles			
Testudines	Turtles	4	7
Class Aves—Birds			
Sphenisciformes	Penguins	1	10
Class Mammalia—Mammals			
Pinnipedia	Seals, Sea lions & Walruses	7	16
Cetacea	Whales	1	2
Phylum Porifera—Sponges		2	29
Phylum Coelenterata			
Class Anthozoa—Corals and Anemones		6	1000
Phylum Annelida			
Class Polychaeta—Marine Worms		2	16
Phylum Arthropoda			
Class Crustacea—Lobsters, Shrimps, Crabs, etc.		9	559
Class Arachnida		1	26
Phylum Mollusca			
Class Gasteropoda—Snails		1	1
Class Pelecypoda—Oysters, Clams, etc.		2	5
Phylum Echinodermata			
Class Asteroidea—Starfishes		7	69
Class Holothuroidea—Sea Cucumbers		1	1
Class Echinoidea—Sea Urchins		3	47
	Totals	177	2524

Summary: Species & Subspecies, 177; Specimens 2524.

GENERAL ACTIVITIES

INSTITUTE FOR RESEARCH IN ANIMAL BEHAVIOR

DONALD R. GRIFFIN, *Director*

DURING 1966 FIVE newly appointed scientists commenced active research work. The new Animal Behavior Laboratory in the former Farm-in-the-Zoo area of the Zoological Park was largely completed, and behavioral studies of finches, penguins and carnivorous bats were well under way by the end of the year. But long before the last of the new research zoologists reached New York, two earlier arrivals had departed for field studies of lions and primates in Africa, while others have been investigating a variety of animals, and of scientific problems, in Trinidad at the William Beebe Tropical Research Station.

PERSONNEL AND RESEARCH

Dr. Peter R. Marler, formerly Professor of Zoology, University of California, Berkeley, was appointed as Senior Research Zoologist and Professor in The Rockefeller University on July 1. In addititon to establishing acoustic isolation chambers and other research facilities for his investigations of bird song at the Animal Behavior Laboratory, he has worked out jointly with the Department of Ornithology detailed plans for a new set of aviaries on the site of a former greenhouse. Stocks of canaries and Bengalese finches are being assembled for use as foster parents in experiments on the roles of learning and inheritance in the development of singing behavior of finches. An extensive comparative study of displays and vocalizations of Cardueline finches was also begun. This survey, in the classical ethological tradition, seeks to reconstruct the evolutionary history of social communication in this group, partly on the basis of field study, mainly from observations of birds kept in captivity and bred under seminatural conditions. In collaboration with the Department of Ornithology stocks of ruff are being recruited with a view to establishing a breeding population. Display actions will be intensively studied by photographic methods and the genetic basis of male plumage polymorphism will be explored. The possibility of special social status for white-ruff males, reported from field work, will be explored with captive birds. Research and exhibit functions may both be served by this project. The same is true of a comparative study of grouse behavior started by Haven Wiley, graduate student at Rockefeller University, and also being developed with considerable help from the Department of Ornithology.

Dr. Richard L. Penney, formerly Assistant Professor at The Johns Hopkins University, was appointed May 1 as Research Zoologist and Assistant Professor at The Rockefeller University. He has established at the Animal Behavior Laboratory a uniquely successful controlled environment chamber (called by some "Little Antarctica") where Adelie penguins are thriving. A research grant from the National Science Foundation is not only providing financial support for these studies, but also airplane transportation to Antarctica through the cooperation of the U. S. Navy. In October Dr. Penney spent about a month at McMurdo Sound and succeeded in bringing 44 Adelie and three Emperor penguins to New York not only without casualties but with three Adelie eggs laid en route. By prior agreement some of the Adelies were turned over to Dr. William Sladen of Johns Hopkins, and the three Emperors were put on exhibit in the Penguin House of the Zoological Park. Nine more eggs were laid by the Adelies, and three chicks hatched, were fed normally by their parents, and remained in excellent condition at the end of the year.

Dr. Penney has set up adjacent to the Animal Behavior Laboratory a 70-foot diameter "air dome" building to provide experimental facilities for analyzing sun navigation of Adelie penguins and other birds. While not a complete planetarium, the inner surface of the opaque hemisphere forms an artificial sky, and a very bright electric lamp provides an artificial sun, the altitude and horizontal position of which is controlled by appropriate mechanical devices. The artificial sky is far enough from the experimental chamber where birds will be studied so that their eyes can remain accommodated for distant vision and so that they can move about without the troublesome problem of parallax errors encountered in smaller orientation cages.

Dr. George Schaller, formerly Assistant Professor at The Johns Hopkins University, was appointed May 1 as Research Zoologist. With the support of a research grant from the National Science Foundation, Dr. Schaller and his family travelled to the Serengeti National Park in Tanzania where he is engaged in an intensive study of the ecology and behavior of the African lion. After spending the first three months becoming familiar with lions in general and with the behavior of prides around Seronera in particular, the next three months were devoted largely to tagging lions and tracing their movements. Out of 101 lions marked for individual recognition sixty have been seen again at least once. Tranquilization with succinylcholine chloride was reasonably successful, but as usual there was great variability in the effective dose. The movements of individual lions have been followed over many weeks, and this has disclosed the formation and disbanding of various types of social and semi-social groups, ranging from the temporary association of two males for a few days to the family groups of mother and young. Despite wide interest in lions, basic ecological and behavioral studies such as these have very seldom been undertaken previously because they place such heavy demands on the patience and stamina of the observing zoologist, but they are essential to the understanding of natural social behavior.

Dr. Roger S. Payne, formerly Assistant Professor at Tufts University, was appointed on July 1 as Research Zoologist and Assistant Professor at The Rockefeller University. He is continuing studies of the remarkably precise directional hearing of owls by means of which they can fly several feet through total darkness to seize a moving mouse. Dr. Payne has constructed a light-tight room at Rockefeller with a blind at one end for observation and photography of owls. The blind is equipped with various kinds of infrared lights so that owls can be observed continuously, or motion pictures taken, in "visible spectrum darkness" (what appears to us and the owls to be total darkness). The fact that owls bring their feet forward at the appropriate moment to prepare for the actual grasping of a mouse in total darkness suggests that their specialized ears inform them not only of the direction of the prey but also its distance. With a hydraulic cylinder, the owl's perch or the surface on which the mouse is walking can be raised or lowered very slowly to determine the accuracy with which distance to the prey is determined by hearing.

Dr. Thomas T. Struhsaker, formerly a post-doctoral Fellow at the University of California, Berkeley, arrived during the fall after attending an international conference on primates in Japan. With the support of a National Science Foundation grant he bagan an 18-month field study in West Africa of the social behavior and ecology of mandrills.

Jocelyn Crane, in addition to the extensive administrative work required to supervise the operations of the Beebe Station in Trinidad during most of the year, has extended her investigations of the social behavior and communication of katydids and their tropical relatives (tettigonioids), fiddler crabs (genus *Uca*), and heliconiine butterflies. The work of Miss Crane and Dr. and Mrs. Michael G. Emsley on the tettigonioids was necessarily devoted in this first year of research, supported by a grant from the National Science Foundation, to becoming familiar with the 50 odd species occurring in the neighborhood of the Beebe Station, obtaining taxonomic identifications when possible, working out methods of keeping adults and rearing nymphs in captivity, and selecting suitable groups of related species for ethological study. Preliminary acoustical recordings have been made and basic information accumulated on ecology, life cycles, and circadian rhythms.

Comparative data on visual aspects of courtship in the least cooperative species of heliconiine butterflies found in Trinidad *(Agraulis vanillae, Dryadula phaetus, Philaethria dido, Heliconius wallacei,* and *H. ethillus)* has virtually completed the long-term ethological studies of this group, the work also supported by a grant from the National Science Foundation.

The ritualized fighting behavior of fiddler crabs received special emphasis, and motion pictures were secured of the characteristic encounters between males, with careful observations of the physiological state and social status of each antagonist. These confirm earlier observations that elaborate interactions between two male crabs involve reciprocal sequences of tapping and rubbing of the large claw against that of the antagonist. Morphological features of the claws, previously considered at best taxonomic conveniences and at worst, because of their variability, systematic exasperations, have now been recognized as having a significant behavioral function.

Dr. John Teal of the Woods Hole Oceanographic Institution carried out pioneering measurements of the metabolic rates of flying birds during brief visits in the winter and spring. Since the Behavior Laboratory was not then completed, he worked in the basement of the Zoo's Monkey House. With recently developed apparatus sensitive to extremely low concentrations of carbon dioxide, Dr. Teal measured the carbon dioxide given off by small birds during a few minutes of forward flight from one end to the other of a "sausage" of inflated plastic about 30 inches in diameter and 25 feet long. Repeated flights back and forth were elicited by simply switching on and off lights located at each end of the sausage, so that to remain in the lighted area the bird was obliged to fly back and forth between perches at each end. These were the first measurements of the metabolic rate of energy expenditure required by birds for reasonably normal forward flight.

Dr. Donald R. Griffin, with the assistance of Robert Brown and Haven Wylie, experimented with preliminary models of a wind tunnel in which birds and bats can be induced to fly in reasonably normal fashion to study orientation behavior, the capture of flying insects, and other behavior patterns involving forward flight.

With the assistance of Mr. and Mrs. Jack Bradbury, Dr. Griffin studied the development of echolocation in young bats at the Beebe Station in Trinidad during July and August. High frequency tape recordings were made of many types of ultrasonic and audible sounds produced by bats at early stages of their growth, including babies only one day in age. These also included what appear to be recognition calls exchanged between mother and young when separated and reunited. Mr. Bradbury has been intensively studying the false vampire bat *(Vampyrum spectrum),* the largest bat in the Western Hemisphere. This is a strictly carnivorous bat, which thrives in captivity on mice, and in the large outdoor flight cage at Simla caught flying birds and small bats with an efficiency that strongly suggested experience in aerial predation under natural conditions. In the Behavior Laboratory Mr. Bradbury has been studying the capabilities of these bats for discriminating between similar targets by echolocation, and this work will probably lead to his Ph.D. thesis at Rockefeller University.

During April bats of the genus *Saccopteryx* were found to emit their characteristic ultrasonic orientation sounds during their diurnal insect hunting. This bat, belonging to the rather primitive family Emballonuridae, has better vision than other insectivorous bats, and often hunts by day in the deep shade of tropical forests. But despite daylight and reasonably good visual acuity the crescendo of rapidly repeated orientation sounds suggest strongly that the interception of flying insects is guided by echolocation to a considerable degree.

THE WILLIAM BEEBE TROPICAL RESEARCH STATION

The active utilization of the Beebe Station at Simla, in the Arima Valley, Trinidad, by staff and visiting scientists has continued to increase during 1966, and for a few days during August no less than 22 scientists were hard at work. Much essential maintenance work was accomplished, ranging from a new and bat-proofed roof on the St. Pat's cottage to completion of the Acoustic Laboratory built with the aid of a grant from the National Science Foundation for research on communication behavior of Arthropods. In December the foreman's cottage was greatly enlarged and modernized.

During the first three months of 1966, Dr. Michael Emsley extended his previous studies of the genetics and color markings of butterflies of the genus *Heliconius* in collaboration with Dr. Keith S. Brown, Jr., of the University of Brazil in Rio de Janiero. On April 1, Dr. Emsley resigned his position as Assistant Director of the Beebe Station, and in December O. Marcus Buchanon was appointed Resident Director, beginning in April, 1967. Mr. Buchanon has been in charge of the Donald Dickey collections and the museum of the Zoology Department at the University of California, Los Angeles. He has had extensive tropical experience in Mexico and Nicaragua.

In January Mrs. Dorothy C. Dunning completed her studies of the behavioral interactions between insectivorous bats and certain moths that emit faint clicks that deter to some extent the bat's accurate location and capture of the moth. This work has been described in her Ph.D. thesis at Tufts University. Also in January, Dr. and Mrs. Hubert Markl completed their investigations of the manner in which leaf-cutting ants communicate by stridulation. Clicking signals produced by ants that have been accidentally buried are detected by other workers which then dig out the buried member of the colony. While faintly audible at close range, these signals are almost certainly transmitted and received as mechanical vibrations of the ground.

During February, six entomologists worked at Simla on a variety of tropical insects: Dr. Jerome Rozen, American Museum of Natural History, on bees; Dr. and Mrs. Donald Duckworth, Smithsonian Institution, on Microlepidoptera; Dr. Theodore Mitchell, North Carolina State University, on bees; Dr. Vernon Vickery, McGill University, and Dr. Harold Grant, the Philadelphia Academy of Natural Sciences, on Orthoptera. Most tragically, Dr. Grant lost his life in a swimming accident during this visit.

In June, Dr. C. Alan Lill from the University of Edinburgh began preliminary observations of the behavior of manakins and certain hummingbirds which set up "leks" or arenas where males do most of their displaying. On the basis of this first hand experience and the resulting concrete plans, Dr. Lill will return in 1967 and 1968 with the aid of a grant from the Air Force Office of Scientific Research to analyze the ethological, genetic and evolutionary aspects of these specialized types of display behavior. These studies are a logical outgrowth of the investigations of Dr. and Mrs. David Snow at the Beebe Station some years ago.

Professor Lincoln P. Brower of Amherst College continued his program of research on mimicry in butterflies, with the collaboration of Dr. Lawrence Cook of the University of Manchester, John Alcock of Harvard University, K. D. Frank and T. Oliver of Amherst College, and Miss R. M. Owens. Their statistical analyses of bird predation on mimics and models were supplemented this year by intensive studies of the behavior of birds presented with natural mimics and models as well as artificially painted moths and butterflies. Mr. Alcock concentrated on the ability of silverbeaked tanagers and fork-tailed flycatchers to "generalize" after experience with one distasteful butterfly to avoid to varying degrees others that resemble it even approximately. Birds also learn to avoid distasteful insects by the experience of seeing another bird of their species taste and reject it.

Dr. Stewart Swihart of the State University College, Fredonia, New York, assisted by Mr. and Mrs. John Baust, continued the electrophysiological analysis of the visual system of butterflies, with special emphasis on color vision and the degree to which selective responses of visual areas of the brain correlate with the wing colors of each species that serve as courtship releasers. Mr. Baust extended previous work in this area by biochemical analyses of pigments found in these butterflies, and Dr. Swihart began neurophysiological studies of the auditory responses of insects.

Dr. Roderick Suthers and Miss Julia Chase of Indiana University extended previous studies of vision in neotropical bats. One of their methods employed the classical response of moving the head to follow moving stripes (the optomotor response), provided the animal can resolve the stripes visually. They also trained nectar-feeding bats to recognize on the basis of visual patterns which of two hummingbird feeders contained sugar solution. These studies of Dr. Suthers and his associates indicate that fruit-eaters and nectar-feeders have relatively better developed eyes and rely less heavily on echolocation than do most of the bats that feed on flying insects.

Dr. and Mrs. Thomas Walker of the University of Florida worked intensively with Jocelyn Crane during a 17-day visit in the summer, making tape recordings of the communication sounds of many species of katydids and their relatives for comparison with the extensive studies of insect sounds that Dr. Walker has carried out in the United States. Also during the summer, Dr. and Mrs. Eric Davidson of Rockefeller University, together with Mr. and Mrs. Paul Kramer, carried out preliminary experiments to determine the feasibility of maintaining large numbers of tropical frogs in outdoor cages and inducing them to breed. During October and November, Dr. Charles Collins, Chapman Fellow in the Department of Ornithology of the American Museum of Natural History, returned to Simla to expand on his previous extensive studies of swifts which were carried out over the past several years and embodied in his Ph.D. thesis at the University of Florida.

Mr. and Mrs. Timothy Williams of Rockefeller University continued their studies of the homing behavior and orientation of the spear-nosed bats *Phyllostomus hastatus* with the aid of radio tracking. Miniature radio transmitters, which add only about 10% to the bat's weight, are attached to the fur of the lower back. When released at distances up to six miles from their home caves near the Beebe Station in Trinidad, almost all of the bats encumbered only with the radio reached home the same night and flew essentially straight towards their home while being followed by radio for one to three miles. Blindfolded bats, on the other hand, were not only slower to find their way home, but failed to show the accurate initial headings. Control bats fitted with goggles having nearly the same weight and causing the same irritation as the blindfolds showed almost normal headings and homing performance. Despite specializations for echolocation, these bats at least seem to require vision for finding their way over distances of several miles.

EDUCATIONAL CONTRIBUTIONS

The symbiosis between the Society and Rockefeller University led to a seminar on animal behavior conducted by Drs. Griffin, Marler, Payne and Penney from October to early January. This year the central theme was animal communication. The discussions were lively and critical, and most of the students visited the research facilities at the Zoological Park and were clearly stimulated by the research opportunities now available. In addition to Timothy Williams, two other Rockefeller graduate students began active research leading toward their Ph.D. theses with members of the Institute for Research in Animal Behavior. As noted above, Jack Bradbury began experiments on discrimination by echolocation and Haven Wylie began investigations of bird displays.

DEPARTMENT OF PUBLICATIONS AND PHOTOGRAPHY

JOHN L. MILLER, *Associate Curator*
DOROTHY REVILLE, *Editorial Assistant*
SAM DUNTON, *Staff Photographer*
WILLIAM MENG, *Photographer*

ON JANUARY 31, William Bridges retired after 31 years as head of the Department and was succeeded by the Associate Curator. The extremely smooth change of command was made possible by Mr. Bridges who had turned over most of the important duties to his successor several months earlier, while remaining on hand to answer any questions or help with problems that came up.

The Department's program for 1966 was, basically, a continuation of the past: *Animal Kingdom, Zoologica, Annual Report,* public relations, the print shop, photography, motion pictures, and cooperative projects like the Annual Meeting and Spring Garden Party programs.

The most significant work during the year was what might best be described as a "renovation" of *Animal Kingdom.*

We set about from the start to give the Society's 32-page, bimonthly magazine a "new look," while at the same time making some minor but important changes in its "personality." The new look began with a new cover. Our choice, first used in the February issue, was made from among several layouts submitted by the Zoo's Department of Exhibition, and like the other changes that followed, it was selected to give the publication a more open, contemporary appearance. The illustration was reduced from the old format to cover the lower two-thirds of the layout, with a white margin at the top and the title set in a different, eye-catching color each issue. Another important change was the series of new typefaces for the main body type, for cutlines, and for headlines.

Among the new features introduced over the first three issues of the year were "About The Cover" and "In This Issue." We took the huge staff list off the inside front, streamlining and reducing it in size as a screened cut. At the same time, the number of illustrations in an average issue was greatly increased, as was the amount of white space. In general, there was a less conservative approach to makeup.

Our interest in changing the magazine's personality was aimed primarily at appealing to a wider audience. It seemed to us necessary to eliminate some of the Bronx Zoo-New York Zoological Society identity prior to seeking an interest by other zoological societies in taking the magazine for their membership.

The reason for doing this is a practical one. *Animal Kingdom* has been (and remains) an extremely expensive "house" publication, costing between 50 and 60 cents per copy to produce. During the 12-month period, its circulation grew by some 2,200 (700 new members; 700 new subscribers; 500 to the Seattle Zoological Society), but even at about 9,000 its audience is insufficient to cut unit costs.

In order to sell the magazine outside the Society membership, we felt that certain features should be changed or eliminated. In the latter category was the practice of listing new members in each issue. It was dropped after the April issue. The practice of carrying a regular "editorial" or comment by Dr. Osborn was, likewise, discontinued after April in favor of occasional editorials when some situation called for the Society to take a stand through its President.

We also sought to substitute less parochial material for some of the incidental Bronx Zoo-New York Aquarium notes in the back of the book. For instance, one idea was to begin a column of news and notes from zoological parks around the United States and Europe. This had not materialized by year's end, but we did begin to insert some information about other institutions.

Many problems were not solved during the past year and considerable work remains. Primary among the problems is the quality of material we have been getting for *Animal Kingdom*. In spite of the fact that we initiated a modest increase in our fees for manuscripts and photographs, neither the quality nor the quantity has improved. In fact, we found ourselves faced over and over with a desperate need for good photographs.

Other Publications Activities

We should note the inclusion of a record insert in the autumn edition of *Zoologica,* the Society's scientific quarterly. The recording was of the underwater sounds of the walrus *(Odobenus)* and was inserted as part of a paper on this subject by Carleton Ray of our own staff and William E. Schevill and William A. Watkins of the Woods Hole Oceanographic Institution. The record was produced on a flexible six-inch disk from the tape-recorded sounds of Olaf, the Aquarium's huge specimen who died in December. They were manufactured by the Ace Recording Studios of Boston, Massachusetts, at a cost of 15 cents apiece.

We went back to press for 5,000 copies of the old Zoo guide, the figure calculated to last until the publication of a new guide being written by Mr. Bridges and to be produced by Golden Press. The Society is also furnishing hundreds of color and black and white photographs for the book.

The Department arranged for a third printing of the Society-sponsored book, "The Physiology of the Pituitary Gland of Fishes," by Pickford and Atz. The arrangement was approved by the Editorial Committee because of a continuing call for the book that had been out of print for some 18 months. We contracted for a run of 500 copies without any revisions in the manuscript.

Mr. Miller also read page proof of the book, "Lemur Behavior—A Madagascar Field Study," published late in the year by the University of Chicago Press and written by Dr. Alison Jolly, who conducted field research under the auspices of the Society.

In passing, we might note that the Editorial Committee was broken up into subcommittees for popular and scientific publications; that a new photo assignment form was designated and printed for Society use; that Mrs. Reville designed the Spring Events folder, the Garden Party and Annual Meeting programs, and a special "endangered species" presentation with text (the latter printed in the Zoo shop).

Photo Library

Considerable time and effort were invested in the selection of photographs and the ordering of new pictures for use in the forthcoming guidebook.

Another major project was the completion of the filing of mammal photographs under a system of zoological orders. Birds and fishes had previously been completed. Reptiles are still to come. The work involved 30 large albums.

Public Relations

We should note briefly that the Department scored heavily in the area of television, arranging for about a dozen spots, most of them of top quality. We did nicely with material in both LIFE and LOOK magazines during the year. Our local newspaper coverage was spotty, consisting mostly of photographs.

We cooperated with the Wolper company for a documentary it produced on dogs, including some material on evolution, and we arranged for some special work in the Zoo by Crowley Films Ltd., of Ottawa, for work on a movie to be called "Motion." The latter was expected to be shown on a continuous basis at "Expo 67," the Montreal fair.

PERSONNEL

Margaret Castora, Mr. Dunton's dark room assistant for a number of years, resigned late in the spring and her place was filled on a temporary basis by Mrs. Helen O'Brien. In October, William Meng was hired as a second photographer and put to work almost exclusively on the guide book.

TRAVEL

Mr. Miller and Mrs. Reville attended the February meeting of the American Association of Zoological Parks and Aquariums in San Diego. Mr. Dunton attended meetings of the Biological Photographic Association in Kingston, Ontario, in May, and in Lexington, Kentucky, in August.

MEMBERSHIP

GORDON CUYLER, *Membership Chairman*

THE ANNUAL mid-winter members' meetings were held on the evenings of January 12 and 13 at the Waldorf-Astoria. On January 12, the city was still in the grip of the transit strike, but 1,200 members and friends managed to reach the ballroom, an impressive demonstration of loyalty and interest. By the second evening the strike had ended and 1,800 people were on hand.

These two meetings were the last produced by Mr. William Bridges, Curator of Publications, who retired in January. For over 30 years, Mr. Bridges was the unifying force that made the annual meetings outstanding events and increasingly popular year after year. Perhaps "producer" is not the right word to describe Mr. Bridges's contributions, for he had a hand in just about everything. He created many of the movies, wrote the scripts, guided the design of the exhibits, and generated a lasting enthusiasm for the Zoological Society and its objectives.

Six members' tours and programs for members' children were again organized in the Zoo and the New York Aquarium, and the Garden Party at the Aquarium on June 15 attracted 1,800 Members and friends, a much greater number than anticipated.

During the year, 1,070 new members were enrolled, chiefly as a result of direct mail campaigns. In the spring, an attractive brochure urging a safari to the Zoo and the Aquarium was mailed, and Dr. Donald Griffin's stimulating newsletter about the homing bats in Trinidad was mailed in the fall.

The total membership by the year's end was 6,308, a net gain of 567 over 1965. Total income also increased from $106,468 in 1965 to $116,358 in 1966, partly as a result of increased enrollment and partly because many members increased their contributions by transfering to higher categories.

JACKSON HOLE BIOLOGICAL RESEARCH STATION

L. FLOYD CLARKE, *Director*

THE NEW BUILDINGS at the Jackson Hole Biological Research Station, three cabins and a library-seminar structure, were furnished and used last summer, providing a great improvement to the facilities. These new buildings were made possible through cooperative financing by the New York Zoological Society and the University of Wyoming, joint sponsors of the Research Station.

The following research projects were conducted during the summer of 1966.

Margaret Altmann—A comparative study of negative messages in big game herds. Supported by University of Colorado.

John W. Baxter—Aquatic fungi of Teton County, Wyoming.

Alan A. Beetle—Trends in vegetation in Teton County, Wyoming. Assisted by Mat Terry; supported by Wyo. Natural Resource Board, Teton Natl. Forest Permittees Assoc., and Wyo. Agri. Exper. Station.

Robert T. Clausen—Sedum of North America, North of the Mexican Plateau. Supported by Cornell University and National Science Foundation.

Martin L. Cody—Bird communities in Jackson Hole. Supported by New York Zoological Society.

Kenneth L. Diem and *Garth S. Kennington*—Some aspects of plant and animal distribution. Assisted by Jane A. Peterson, Student Conservation Program; supported by the University of Wyoming.

Dorothy Feir—Effects of high altitudes on the hemolymph of insects. Assisted by Elizabeth McClain, Student Conservation Program; Supported by Cancer Res. Institutional Committee, St. Louis University.

Douglas Flack—Study of relations of bird populations to structure in aspen stands. Assisted by Ann Scott, Student Conservation Program; supported by New York Zoological Society.

Douglas B. Houston—An ecological-physiological study of moose. Supported by National Park Service.

Richard Lee Kroger—Analysis of the insect fauna of the Snake River. Supported by National Park Service.

Glenn A. Noble—Stress and parasitism. Assisted by Jeanne H. Williams, Student Conservation Program.

Paul G. Roofe—Salamander study.

Dale L. Taylor—Biotic succession in lodgepole pine forests of fire origin in Yellowstone National Park. Supported by New York Zoological Society and Yellowstone National Park.

William Thurmond—Melanophore-stimulating substances in Amphibia.

The following are research projects supported by the National Park Service under the Student Conservation Program:

Elizabeth McClain—Effects of high altitudes on the hemolymph of insects.

Jane A. Peterson—Organ weight measurements from four populations of *Thomomys talpoides.*

Ann Scott—A study of the flora of aspen communities in Jackson Hole.

Jeanne H. Williams—The diet of the Uinta ground squirrel (*Citellus armatus*).

FINANCIAL STATEMENTS

EXHIBIT A

NEW YORK ZOOLOGICAL SOCIETY

BALANCE SHEET • December 31, 1966

ASSETS

Cash		$ 568,324.26
Investments (quoted market value $13,312,770.84)		12,254,406.96
Receivables:		
City of New York	$ 389,369.39	
Other	108,980.35	498,349.74
Inventories, at cost:		
Park facilities	38,945.59	
Aquarium	6,035.28	44,980.87
Facilities' assets, at cost less depreciation:		
Zoological Park (note 1)	309,290.01	
Aquarium	22,190.54	331,480.55
Prepaid expenses and deferred charges		43,127.42
National collection of heads and horns, art gallery, library and sundry items	at nominal amounts	1.00
Collection of living animals		1.00
Jackson Hole Research Station buildings		1.00
Simla Tropical Research Station		1.00
Coney Island real estate		1.00
		$13,740,674.80

LIABILITIES AND FUNDS

Accounts payable and accrued expenses		542,463.41
Funds:		
Endowment funds – principal nonexpendable (Exhibit C)	2,354,087.41	
Funds functioning as endowment – principal expendable (Exhibit C)	5,223,871.37	
General funds (Exhibit D)	4,216,882,49	
Special purpose funds (Exhibit E)	1,403,370.12	
		13,198,211.39
		$13,740,674.80

See accompanying notes to financial statements.

Exhibit B

STATEMENT OF INCOME, EXPENDITURES AND APPROPRIATIONS

Year ended December 31, 1966

Income:	*Gross*	*Costs*	*Net*
Investments—interest and dividends	$ 546,489.35	—	546,489.35
Gain on disposal of investments, net	25,294.58	—	25,294.58
Annual dues	120,758.40	—	120,758.40
Gifts for operations	10,394.24	—	10,394.24
Portion of special purpose grants for operating costs	34,479.49	—	34,479.49
Sales of publications and photographs	11,246.15	—	11,246.15
Other	35,495.74	—	35,495.74
	784,157.95	—	784,157.95
Transfer from special purpose funds	1,633,294.68	—	1,633,294.68
Zoological Park:			
Operations and maintenance	1,501,101.28(1)	1,806,041.40	(304,940.12)
Facilities and admissions	1,453,453.73	1,042,500.40	410,953.33
New York Aquarium:			
Operations and maintenance	372,127.28(1)	462,471.04	(90,343.76)
Facilities	173,798.98	92,471.42	81,327.56
Total	$5,917,933.90	3,403,484.26	2,514,449.64
Expenditures:			
Improvements:			
Zoological Park		$ 477,365.13	
New York Aquarium		760,314.44(2)	
Research		429,566.30	
Purchase of animals		68,121.68	
Conservation of natural resources and animal life		113,830.44	
Education		36,832.03	
Publications		92,084.19	
Membership		61,377.34	
Executive		58,439.47	
Employee benefits		63,992.93	
Other		81,343.07	
Total Expenditures			2,243,267.02
Excess of income over expenditures			271,182.62
Appropriations to special purpose funds			430,953.33
Net change for year			$ (159,770.71)
Distributed as follows:			
General working fund			(68,960.31)
General development fund			(90,810.40)
			$ (159,770.71)

(1) Includes:	*Zoological Park*	*New York Aquarium*
Provided by City of New York	$1,501,101.28	144,821.73
Aquarium admission fees	—	227,305.55
	$1,501,101.28	372,127.28

(2) Includes Osborn Laboratories of Marine Sciences

See accompanying notes to financial statements.

Exhibit C

STATEMENT OF CHANGES IN ENDOWMENT FUNDS AND FUNDS FUNCTIONING AS ENDOWMENT

Year ended December 31, 1966

	Endowment funds	*Funds functioning as endowment*
Balance at beginning of year	$ 2,315,900.50	5,238,823.37
Add gain on disposal of investments, net	38,186.91	85,048.00
	2,354,087.41	5,323.871.37
Deduct transfer to general working fund	—	100,000.00
Balance at end of year	$ 2,354,087.41*	5,223,871.37

*Balance consisting of:

George F. Baker fund	174,722.00
Cadwalader Animal fund	31,905.00
Edward P. Casey fund	130,594.18
Mary Thurston Cockroft fund	61,525.53
Grant fund for the protection of wildlife	39,591.09
Robert Jaffray fund	22,255.66
Madison Grant scientific research fund	84,708.32
William Pyle Philips fund	16,250.63
Rockefeller fund	1,613,962.12
Jacob H. Schiff fund	170,410.07
Stokes bird fund	8,162.81
	$ 2,354,087.41

See accompanying notes to financial statements.

Exhibit D

STATEMENT OF CHANGES IN GENERAL FUNDS

Year ended December 31, 1966

	Total	*General working*	*General development*	
Balance at beginning of year	$ 3,585,027.18	18,447.04	3,566,580.14	
Gifts and legacies	832,603.07	–	832,603.07	
Distribution—excess of expenditures and appropriations over income for the year	(159,770.71)	(68,960.31)	(90,810.40)	
Transfers:				
Funds functioning as endowment	100,000.00	100,000,00	–	
Special purpose funds	(133,976.00)	–	(133,976.00)	
Direct expenditures	(7,001.05)	–	(7,001.05)	(1)
Balance at end of year	$ 4,216,882.49	49,486.73	4,167,395.76	(2) (3)

(1) Direct costs for fund raising expenses of campaign office.

(2) Balance consisting of:

General capital funds	$ 1,790,779.63
General uses	1,907,740.77
New York Zoological Park uses only	128,480.00
New York Aquarium uses only	27,834.15
Planting and landscaping in the New York Zoological Park	8,410.74
Scientific purposes only	22,853.75
Marine Biological Laboratory	50,000.00
Wildlife Survival Center	52,706.35
Research Center in the New York Zoological Park	990.37
African Plains project	100.00
Bear dens	1,000.00
World of Birds construction	176,500.00
	$ 4,167,395.76

(3) Not including pledges.

See accompanying notes to financial statements.

Exhibit E

STATEMENT OF CHANGES IN SPECIAL PURPOSE FUNDS

Year ended December 31, 1966

Balance at beginning of year		$2,037,440.80
Additions:		
Gifts and grants	$ 447,273.56	
Investment income	21,500.60	
Transfers and appropriations:		
Operations	430,953.33	
General funds	133,976.00	1,033,703.49
		3,071,144.29
Deduct transfers to income:		
Amount equivalent to expenditures for purposes of the various funds	1,633,294.68	
Operating costs	34,479.49	
		1,667,774.17
Balance at end of year		$1,403,370.12*

*Consisting of:

Conservation account	88,073.25
William E. Damon fund	51,217.28
Animal fund	36,536.65
African Wildlife fund	46,815.05
College aid for education	709.00
Doris Duke Foundation grant	3,754.36
Michael Grzimek Memorial fund	133.00
The John A. Hartford Foundation grant	97,407.91
Improvement and repair account	22,102.59
Henry Krumb fund	6,584.65
Income from Madison Grant Scientific Research fund	12,057.67
Park improvement account	5,901.90
Animal Behavior Laboratory fund	7,929.43
Institute for Research of Animal Behavior fund	1,191.31
National Institute of Health grants	18,361.98
Atomic Energy Commission grants	(12,008.17)
Argentine Wildlife Film fund	2,375.60
Scholarship loan program fund	1,290.23
Kodiak and polar bear fund	2,608.00
The world of birds fund	8,069.37
The world of darkness fund	115,401.35
Poisonous Snakes of the World fund	(2,940.05)
Kangaroo house, eagle and vulture fund	2,098.44
Carried forward	$ 515,670.80

Consisting of, continued:

Brought forward	$ 515,670.80
Marine virology grant	85,000.00
Edwin F. Gamble bird fund	1,041.25
New York Aquarium—special development study	8,000.00
Deep freeze at New York Aquarium	13,148.85
Park facilities operating fund	747,022.47
New York Aquarium construction fund	33,486.75
	$1,403,370.12

See accompanying notes to financial statements.

NOTES TO FINANCIAL STATEMENTS

(1) Park facilities' assets are subject to an agreement with the City of New York, and the net income from park facilities' operations may be used only for the purchase of animals and the improvement of Zoological Park.

(2) The balance sheet does not include the assets and liabilities of the Pension Fund.

(3) The New York Zoological Society and the City of New York have agreed to construct an Aquarium, as funds become available, at an estimated total cost (to be shared equally) of $7,100,000.00, of which the initial stage (of approximately $1,550,000.00) was completed May 31, 1957.

PEAT, MARWICK, MITCHELL & CO.
Certified Public Accountants
Seventy Pine Street
New York, New York 10005

ACCOUNTANT'S REPORT

The Board of Trustees
New York Zoological Society:

We have examined the balance sheet of New York Zoological Society as of December 31, 1966 and the related statements of income, expenditures and appropriations and changes in fund balances for the year then ended. Our examination was made in accordance with generally accepted auditing standards, and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances. It was not practicable to confirm the receivable from the City of New York by communication with it, but we satisfied ourselves as to the amount by means of other auditing procedures.

In our opinion, the accompanying balance sheet and statements of income, expenditures and appropriations and changes in fund balances present fairly the financial position of New York Zoological Society at December 31, 1966 and the results of its operations for the year then ended, in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

Peat, Marwick, Mitchell & Co.

April 24, 1967

THE PENSION FUND

(Founded by Andrew Carnegie)

STATEMENT OF CASH TRANSACTIONS

Year ended December 31, 1966

Balance at beginning of year:				
Investments (quoted market value $3,203,625.39)				$2,730,876.36
Uninvested balance of cash				88,859.22
				2,819,735.58
Receipts:				
Income from investments:				
Interest			$ 86,410.03	
Dividends			50,995.07	
			137,405.10	
Contributions by employees—regular			16,181.21	153,586.31
				2,973,321.89
Expenditures:				
Refunds on account of resignations			15,329.66	
Pension disbursements			87,793.80	
Death benefit disbursements			3,200.68	
Custodian fees			951.15	107,275.29
				2,866,046.60
Net gain on investment transactions				22,109.15
	Value			
	Quoted market	Book		
Balance at end of year:				
Investments:				
Bonds	$1,906,673.76	2,084,056.21		
Preferred stocks	68,612.50	88,879.59		
Common stocks	1,017,079.88	684,051.33		
	$2,992,366.14		2,856,987.13	
Uninvested balance of cash		31,993.60		
Less payable to Society		824.98	31,168.62	
				$2,888,155.75

PEAT, MARWICK, MITCHELL & CO.
Certified Public Accountants
Seventy Pine Street
New York, New York 10005

ACCOUNTANT'S REPORT

The Board of Trustees
New York Zoological Society:

We have examined the statement of cash transactions of The Pension Fund (founded by Andrew Carnegie) of the New York Zoological Society for the year ended December 31, 1966. Our examination was made in accordance with generally accepted auditing standards, and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

In our opinion, the accompanying statements of cash transactions for the year ended December 31, 1966, presents fairly the results of cash transactions of The Pension Fund of the New York Zoological Society for the year then ended and the assets of the Fund at December 31, 1966, on a basis consistent with that of the preceding year.

Peat, Marwick, Mitchell & Co.

March 17, 1967

PEAT, MARWICK, MITCHELL & CO.
CERTIFIED PUBLIC ACCOUNTANTS
Seventy Pine Street
New York, New York 10005

ACCOUNTANT'S REPORT

THE BOARD OF TRUSTEES
NEW YORK ZOOLOGICAL SOCIETY:

We have examined the statement of the Principal Fund of the Permanent Wild Life Protection Fund for the year ended December 31, 1966, set forth below:

Amount due from New York Zoological Society	$ 3,001.21
Investments, at book value (quoted market value $218,862.00)	202,115.63
Principal Fund at beginning and end of year	$205,116.84

Our examination was made in accordance with generally accepted auditing standards, and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

In accordance with the agreement establishing this Fund, the income from the investments of $10,563.45 was paid over to the New York Zoological Society to be used for the specific purposes set forth in such agreement.

In our opinion, the above statement of Principal Fund presents fairly the financial position of the Permanent Wild Life Protection Fund at December 31, 1966, in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

PEAT, MARWICK, MITCHELL & CO.

March 13, 1967

NEW YORK ZOOLOGICAL SOCIETY

INCORPORATION of the New York Zoological Society by the State of New York was accomplished under Chapter 435 of the Laws of 1895 and the basic purposes of the Society were embodied in Section 2:

> Said corporation shall have power to establish, maintain and control zoological parks, gardens, or other collections for the promotion of zoology and kindred subjects, and for the instruction and recreation of the people. Said corporation may collect, hold and expend funds for zoological research and publication, for the protection of wild animal life, and for kindred purposes, and may promote, form, and co-operate with other associations with similar purposes, and may purchase, sell, or exchange animals, plants, and specimens appropriate to the objects for which it was created.

Subsequently, at a special meeting of the Commissioners of the Sinking Fund, City of New York, held on March 24, 1897, a resolution was passed allotting South Bronx Park for the use of the New York Zoological Society and establishing the terms of a management agreement under which the Society has operated since that date, with only minor modifications.

The resolution of March 24, 1897, and the supplemental agreement of January 24, 1942, provided that the Society should furnish the original equipment of buildings and animals, that it should raise $250,000 by subscription within three years of the date of starting work on the improvement of the grounds, that the Society should have the right to establish an endowment fund to be used solely for the general uses and purposes of the Society unless otherwise specified by the donors, that the City of New York should provide funds for the maintenance and care of the Zoological Park and for the maintenance of the animal collections, that the Zoological Park should be open to the public free at least four days a week, that the Society may expend the net proceeds of facilities only for the purchase of animals and the improvement of the Zoological Park and that the Society should have the right to make and control all appointments of employees and to fix salaries and make promotions.

NEW YORK ZOOLOGICAL SOCIETY

Organized 1895

Presidents

I.	Andrew H. Green	1895 to 1897
II.	Levi P. Morton	1897 to 1909
III.	Henry Fairfield Osborn	1909 to 1925
IV.	Madison Grant	1925 to 1937
V.	W. Redmond Cross	1937 to 1940
VI.	Fairfield Osborn	1940

First Vice-presidents

I.	J. Hampton Robb	1895 to 1897
II.	Henry Fairfield Osborn	1897 to 1909
III.	Samuel Thorne	1909 to 1916
IV.	Madison Grant	1916 to 1925
V.	Frank K. Sturgis	1925 to 1932
VI.	W. Redmond Cross	1932 to 1937
VII.	Kermit Roosevelt	1937 to 1939
VIII.	Alfred Ely	1939 to 1959
IX.	Laurance S. Rockefeller	1959

Second Vice-presidents

I.	Charles E. Whitehead	1895 to 1902
II.	John L. Cadwalader	1902 to 1915
III.	Madison Grant	1915 to 1916
IV.	Frank K. Sturgis	1916 to 1925
V.	Henry D. Whiton	1925 to 1930
VI.	Kermit Roosevelt	1930 to 1937
VII.	Alfred Ely	1937 to 1939
VIII.	Laurance S. Rockefeller	1939 to 1959
IX.	Henry Clay Frick, II	1966
X.	Rorert G. Goelet	1966

Honorary Vice-president

I.	DeForest Grant	1957 to 1960

Treasurers

I.	L. V. F. Randolph	1895 to 1901
II.	Charles T. Barney	1901 to 1903
III.	Percy Rivington Pyne	1903 to 1922
IV.	Cornelius R. Agnew	1922 to 1953
V.	David Hunter McAlpin	1953

Secretaries

I.	Madison Grant	1895 to 1925
II.	William White Niles	1925 to 1935
III.	Fairfield Osborn	1935 to 1940
IV.	Harold J. O'Connell	1941 to 1959
V.	G. W. Merck	1959 to 1964
VI.	John Elliott	1964

Chairmen, Executive Committee

I.	Charles E. Whitehead	1895 to 1896
II.	Henry Fairfield Osborn	1896 to 1903
III.	Charles T. Barney	1903 to 1907
IV.	Henry Fairfield Osborn	1907 to 1909
V.	Madison Grant	1909 to 1937
VI.	W. Redmond Cross	1937 to 1940
VII.	Laurance S. Rockefeller	1940 to 1943
VIII.	Fairfield Osborn	1943 to 1945
IX.	Laurance S. Rockefeller	1945

Directors

I.	William T. Hornaday	Zoological Park	1896 to 1926
II.	Charles H. Townsend	New York Aquarium	1902 to 1937
III.	W. Reid Blair	Zoological Park	1926 to 1940
IV.	Allyn R. Jennings	Zoological Park	1940 to 1941
V.	Charles M. Breder, Jr.	New York Aquarium	1937 to 1943
VI.	John Tee-Van	Zoological Park	1952 to 1956
		General Director, Zoological Park & Aquarium	1956 to 1962
VII.	Christopher W. Coates	New York Aquarium	1956 to 1964
VIII.	James A. Oliver	Zoological Park	1958 to 1959
IX.	William G. Conway	Zoological Park	1961
		General Director	1966
X.	Paul L. Montreuil	New York Aquarium	1964 to 1966
XI.	Ross F. Nigrelli	New York Aquarium	1966

BOARD OF TRUSTEES

City of New York
Ex-officio

Hon. John V. Lindsay, *The Mayor*
Hon. Thomas P. F. Hoving,
Administrator of Recreation and Cultural Affairs & Commissioner of Parks

Class of 1967

Alexander Aldrich
George F. Baker, Jr.
John Elliott
Robert I. Gannon, S. J.
Peter Grimm
Fairfield Osborn
Eben W. Pyne
Laurance S. Rockefeller
John M. Schiff
Henry Sears
Joseph A. Thomas
Robert Winthrop

Class of 1968

Charles W. Engelhard
Peter R. Gimbel
Robert G. Goelet
John N. Irwin, II
Warren Kinney
Peter Matthiessen
Charles W. Nichols, Jr.
Howard Phipps, Jr.
John Pierrepont
David T. Schiff
Chauncey Stillman
Landon K. Thorne, Jr.

Class of 1969

Robert E. Blum
William R. Coe
C. Suydam Cutting
Henry Clay Frick, II
Anthony D. Marshall
Otto Marx, Jr.
David Hunter McAlpin
G. W. Merck
Augustus G. Paine, II
Richard C. Patterson, Jr.*
John H. Phipps
Alfred G. Vanderbilt

*Died in 1966

OFFICERS OF THE SOCIETY

Fairfield Osborn, *President*
Laurance S. Rockefeller, *First Vice-President*
Henry Clay Frick, II, *Vice-President*
Robert G. Goelet, *Vice-President*
John Elliott, *Secretary*
Harold C. Palmer, *Assistant Secretary*
David Hunter McAlpin, *Treasurer*
Eben W. Pyne, *Assistant Treasurer*
General Office: 630 Fifth Avenue, New York, N. Y. 10020

EXECUTIVE COMMITTEE

Laurance S. Rockefeller, *Chairman*

George F. Baker, Jr.
John Elliot, *ex-officio*
Henry Clay Frick, II
Peter R. Gimbel
Robert G. Goelet
Thomas P. F. Hoving, *ex-officio*
John N. Irwin, II
David Hunter McAlpin, *ex-officio*
Fairfield Osborn, *ex-officio*
John Pierrepont

PENSION BOARD

Fairfield Osborn, *Chairman*

William G. Conway
John Elliot
Walter Lerchenfeld
David Hunter McAlpin
John McKew
Ross F. Nigrelli
John Pierrepont
Eben W. Pyne
William Souhrada

COMMITTEES OF THE SOCIETY

NOMINATING COMMITTEE FOR BOARD OF TRUSTEES

E. Roland Harriman, *Chairman*

Eli Whitney Debevoise
B. Danforth Ely

FINANCE COMMITTEE

Augustus G. Paine, *Chairman*

John Elliott
David Hunter McAlpin, *ex-officio*
Fairfield Osborn, *ex-officio*
Eben W. Pyne
John M. Schiff

AUDITING COMMITTEE

George F. Baker, Jr., *Chairman*

John Elliott, *ex-officio*
Fairfield Osborn, *ex-officio*
Howard Phipps, Jr.

EDITORIAL COMMITTEE

Fairfield Osborn, *Chairman*

William G. Conway
Lee S. Crandall
Joseph A. Davis, Jr.
Herndon G. Dowling
Donald R. Griffin
John L. Miller
Ross F. Nigrelli

HEADS AND HORNS COMMITTEE

Laurance S. Rockefeller
John Tee-Van
Samuel B. Webb
F. Carrington Weems

STAFF

WILLIAM G. CONWAY, *General Director*
JOHN TEE-VAN, *General Director Emeritus, Zoological Park and Aquarium*

ZOOLOGICAL PARK

WILLIAM G. CONWAY, *Director & Curator, Birds*
CHARLES B. DRISCOLL, *Superintendent, Operations*
JOSEPH A. DAVIS, JR., *Curator, Mammals*
HUGH B. HOUSE, *Assistant Curator, Mammals*
ROLAND LINDEMANN, *Consultant in Mammal Management*
JOSEPH BELL, *Assistant Curator, Birds*
GRACE DAVALL, *Assistant Curator, Mammals & Birds*
HERNDON G. DOWLING, *Curator, Reptiles*
VICTOR H. HUTCHISON, *Research Associate, Herpetology*
ALLEN VINEGAR, *Visiting Research Fellow, Herpetology*
CHARLES P. GANDAL, *Veterinarian*
GORDON CUYLER, *Membership Chairman & Administrative Associate*
HERBERT J. KNOBLOCH, *Curator, Education*
JERRY M. JOHNSON, *Curator, Exhibitions & Graphic Arts*
EDWARD KEARNEY, *Manager, Facilities Department*
LEE S. CRANDALL, *General Curator Emeritus*

AQUARIUM

ROSS F. NIGRELLI, *Director*
ROBERT A. MORRIS, *Associate Curator*
JEWELL BUNGAY, *Business Manager*
GUIDO CHIBAS, *Associate Superintendent*
LOUIS MOWBRAY, *Associate in Field Biology*
CARLETON RAY, *Field Associate*
CHRISTOPHER W. COATES, *Director Emeritus*

OSBORN LABORATORIES OF MARINE SCIENCES

ROSS F. NIGRELLI, *Director & Pathologist*
MARTIN F. STEMPIEN, JR., *Assistant to the Director & Research Associate, Bio-Organic Chemistry*
WILLIAM ANTOPOL, *Research Associate, Comparative Pathology*
C. M. BREDER, JR., *Research Associate, Ichthyology*
JACK T. CECIL, *Research Associate, Marine Virology*
HARRY A. CHARIPPER, *Research Associate, Histology*
KENNETH GOLD, *Research Associate, Radiation Ecology*

Thomas Goreau, *Research Associate, Marine Ecology*
Myron Jacobs, *Research Associate, Comparative Pathology*
Klaus Kallman, *Geneticist*
John J. A. McLaughlin, *Research Associate, Planktonology*
George D. Ruggieri, S. J., *Research Associate, Experimental Embriology & Teratology*
Martin P. Schreibman, *Research Associate, Fish Endocrinology*

INSTITUTE FOR RESEARCH IN ANIMAL BEHAVIOR

[Jointly operated by the Society and The Rockefeller University, and including the Society's William Beebe Tropical Research Station, Trinidad, West Indies]

Donald R. Griffin, *Director & Senior Research Zoologist*
Peter R. Marler, *Senior Research Zoologist*
Jocelyn Crane, *Senior Research Ethologist*
Roger S. Payne, *Research Zoologist*
Richard L. Penney, *Research Zoologist*
Fernando Nottebohn, *Research Zoologist*
George Schaller, *Research Zoologist*
Thomas T. Struhsaker, *Research Zoologist*
C. Alan Lill, *Research Fellow*
O. Marcus Buchanon, *Resident Director, William Beebe Tropical Research Station*

GENERAL

Walter Lerchenfeld, *Comptroller*
John McKew, *Personnel Manager & Assistant to the Director, Zoological Park*
John L. Miller, *Editor & Associate Curator, Publications*
Dorothy Reville, *Editorial Assistant*
Sam Dunton, *Photographer*
Henry M. Lester, *Photographic Consultant*

AFFILIATES

CONSERVATION FOUNDATION

Founded by
New York Zoological Society
in 1948

President
Russell E. Train

Chairman of the Board
Fairfield Osborn

Vice-chairman
Laurance S. Rockefeller

JACKSON HOLE BIOLOGICAL RESEARCH STATION

Founded by the New York Zoological Society in 1947 and under the sponsorship of the Society and the University of Wyoming

Director
L. Floyd Clarke

MEMBERSHIP IN THE NEW YORK ZOOLOGICAL SOCIETY

THE NEW YORK ZOOLOGICAL SOCIETY was founded in 1895 for the "instruction and recreation of the people" through the establishment of a Zoological Park, for the promotion of zoology through exhibition of collections, publications, research and exploration, and for the conservation of animal life of the world. Since 1899 the Zoological Society has directed the New York Zoological Park and in 1902 it was entrusted with the management of the New York Aquarium.

MEMBERSHIP is actively invited of all persons who are interested in the objects of the Society and desire to contribute towards its support.

ANNUAL MEMBERSHIP is $15. Contributing Membership is $25. Supporting Membership is $100. These Memberships entitle the holders to Member's cards for admission (including parking) to the Zoological Park on pay days, and 5 to the Aquarium on any day; a copy of the *Annual Report;* a subscription to *Animal Kingdom,* the bi-monthly publication of the Society; privileges of the Library and Members' Lounge in the Administration Building of the Zoological Park and to attend all open meetings of the Society. Tickets to all sections of the Zoological Park for which an admission charge is made are available, free, to Members upon application at the Administration Building in person. Members will be taken on "behind the scenes" tours of the Zoological Park and Aquarium, without charge, on application, and are entitled to 20% discount on all publications of the Society. We are advised that Contributing and Supporting Membership fees are deductible from income tax within the legal limits.

LIFE MEMBERSHIP is $500. See By-laws for conversion of Annual, Contributing and Supporting to Life Membership. Other classes of membership are: Patron, $1,000; Associate Founder, $2,500; Founder, $5,000; Founder in Perpetuity, $10,000; Benefactor, $25,000.

APPLICATIONS for membership may be submitted to any officer of the Society at the Zoological Park or the Aquarium, or to the Society's general office at 630 Fifth Avenue, New York, N.Y. 10020.

FORM OF BEQUEST

I do hereby give and bequeath to the "New York Zoological Society," of the City of New York..........................

....

(For purposes of the Federal income tax, contributions to the Society, including a portion of membership dues, are deductible in an amount up to 30% of the donor's adjusted gross income. Bequests to the Society are deductible for Federal estate tax purposes).

FELLOWS OF THE NEW YORK ZOOLOGICAL SOCIETY

Amadon, Dean
Anable, Mrs. Anthony
Anthony, H. E.
Antopol, William
Aronson, Lester R.
Atz, James W.
Beach, Frank A.
Bogert, Charles M.
Boyden, Alan
Breder, C. M., Jr.
Brown, M. Vertner
Budinger, John M.
Carpenter, C. R.
Carter, T. Donald
Cazier, Mont A.
Charipper, H. A.
Clark, James L.
Clarke, L. Floyd
Coates, Christopher W.
Colbert, Edwin H.
Conant, Roger
Conway, William
Coolidge, Harold J.
Cousteau, Jacques-Yves
Cox, Richard T.
Crandall, Lee S.
Crane, Jocelyn
Curran, C. H.
Delacour, Jean
Dowling, Herndon G.
Elton, Charles
Emerson, Alfred E.
Enders, Robert K.
Fleming, Henry
Gandal, Charles P.
Gertsch, W. J.
Goodwin, George G.
Gorbman, Aubrey
Goss, Leonard J.
Gregory, William K.
Griffin, Donald R.
Haskins, Caryl P.
Hatt, Robert Torrens
Jakowska, Sophie
Kazimiroff, Theodore
LaMonte, Francesca R.
Lloyd, Hoyes
McClure, Gervase W.
Mayr, Ernst
Wallach, Jacques
Merriman, Daniel
Mettler, Fred A.
Murphy, Robert Cushman
Nachmansohn, David
Nigrelli, Ross F.
Oliver, James A.
Parr, Albert Eide
Peterson, Roger Tory
Ponder, Eric
Pope, Clifford H.
Riess, Bernard F.
Ripley, S. Dillon, 2nd
Schneirla, T. C.
Schroeder, Charles R.
Scott, J. Paul
Simon, James R.
Stunkard, Horace W.
Tee-Van, John
Van Gelder, Richard G.
Vogt, William

SUMMARY OF MEMBERSHIP

December 31, 1966

Benefactors	27
Founders in Perpetuity	18
Founders	15
Associate Founders	27
Patrons	72
Life Members	352
Supporting Members	202
Contributing Members	1,864
Annual Members	3,649
Fellows	70
Research Associates	3
Corresponding Members	3
Honorary Members	6
Total	6,308